Volume IV of V, Appx8923 to Appx11363
No. 23-1922

In the
United States Court of Appeals
for the Federal Circuit

BEARBOX LLC, AUSTIN STORMS,

Plaintiffs-Appellants,

v.

LANCIUM LLC, MICHAEL T. McNAMARA, RAYMOND E. CLINE, JR.,

Defendants-Appellees.

Appeal from the United States District Court
for the District of Delaware, No. 1:21-cv-00534-GBW-CJB
The Honorable Gregory B. Williams

JOINT APPENDIX

ADAM M. KAUFMANN
BARNES & THORNBURG LLP
One North Wacker Drive, Suite 4400
Chicago, Illinois 60606
(312) 357-1313

MARK C. NELSON
BARNES & THORNBURG LLP
2121 North Pearl Street, Suite 700
Dallas, Texas 75201
(214) 258-4200

CHAD S.C. STOVER
BARNES & THORNBURG LLP
222 Delaware Avenue, Suite 1200
Wilmington, Delaware 19801
(302) 300-3434

Counsel for Appellees, Lancium LLC, Michael T. McNamara and *Raymond E. Cline, Jr.*

BENJAMIN T. HORTON
JOHN R. LABBE
RAYMOND R. RICORDATI, III
CHELSEA MURRAY
MARSHALL, GERSTEIN & BORUN LLP
233 South Wacker Drive
6300 Willis Tower
Chicago, IL 60606-6357
(312) 474-6300

Counsel for Plaintiffs-Appellants BearBox LLC and *Austin Storms*

INDEX OF JOINT APPENDIX

Document Description	Date	Docket/ Exhibit No.	Appx Pages
Letter to The Honorable Maryellen Noreika from Andrew C. Mayo regarding joint status report in connection with request for claim construction hearing.	2021-08-31	D.I. 54	Appx1501
Letter to Judge Christopher J. Burke from Chad S.C. Stover regarding Claim Construction.	2021-10-15	D.I. 63	Appx1537
REPORT AND RECOMMENDATIONS re 32 MOTION for Judgment on the Pleadings	2022-01-18	D.I. 92	Appx1615-1623
ORDER ADOPTING 92 REPORT AND RECOMMENDATION GRANTING 32 Motion for Judgment on the Pleadings	2022-02-02	D.I. 97	Appx1630
Second AMENDED COMPLAINT against Raymond E. Cline, Jr, Lancium LLC, Michael T. McNamara	2022-02-16	D.I. 103	Appx1631-1734
Letter to The Honorable Christopher J. Burke from Andrew C. Mayo regarding response to motion to strike	2022-03-10	D.I. 113	Appx1848
OPENING BRIEF in Support re 120 MOTION to Dismiss	2022-03-16	D.I. 121	Appx2024-2041
REPORT AND RECOMMENDATION	2022-05-26	D.I. 143	Appx2339
OBJECTION to 143 Report and Recommendations by Raymond E. Cline, Jr, Lancium LLC, Michael T. McNamara.	2022-06-09	D.I. 146	Appx2506-2567
OPENING BRIEF in Support re 148 MOTION for Summary Judgment	2022-06-15	D.I. 149	Appx2611-2656

Document Description	Date	Docket/ Exhibit No.	Appx Pages
ORAL ORDER	2022-11-14	D.I. 232	Appx6074-6075
Letter to The Honorable Gregory B. Williams from Chad S.C. Stover regarding Defendants' Opening Letter Brief in Support of its Emergency Motion to Stike Plaintffs' Newly Disclosed, Untimely Expert Report and Request for Expedited Briefing - re 236 MOTION to Strike	2022-11-15	D.I. 237	Appx6089-6191
Proposed Pretrial Order by BearBox LLC, Austin Storms	2022-11-15	D.I. 239	Appx6216 Appx6639-6653s
Letter to The Honorable Gregory B. Williams from Andrew C. Mayo regarding response to defendants' motion to strike	2022-11-18	D.I. 241	Appx6744-6940
REDACTED VERSION of 237 Letter,, by Raymond E. Cline, Jr, Lancium LLC, Michael T. McNamara	2022-11-22	D.I. 246	Appx6974-6975
POST TRIAL BRIEF by BearBox LLC, Austin Storms	2023-01-11	D.I. 256	Appx7104-7105 Appx7107-7120
Proposed Findings of Fact by BearBox LLC, Austin Storms	2023-01-11	D.I. 257	Appx7132 Appx7150
POST TRIAL BRIEF *(Response)* by Raymond E. Cline, Jr, Lancium LLC, Michael T. McNamara	2023-01-25	D.I. 258	Appx7163-7165
Proposed Findings of Fact by Raymond E. Cline, Jr, Lancium LLC, Michael T. McNamara	2023-01-25	D.I. 259	Appx7189-7196
POST TRIAL BRIEF (Reply) by BearBox LLC, Austin Storms	2023-02-01	D.I. 260	Appx7219
ANSWERING BRIEF in Opposition re 269 MOTION for Attorney Fees and Expenses	2023-05-03	D.I. 273	Appx7484
NOTICE OF APPEAL to the Federal Circuit of 267 Judgment	2023-05-04	D.I. 274	Appx7973-7974

Document Description	**Date**	**Docket/ Exhibit No.**	**Appx Pages**
Trial Transcript (Volumes I - III)	12/6/2022 through 12/8/2022		Appx8005 Appx8007 Appx8010 Appx8017-8026 Appx8029-8030 Appx8033-8035 Appx8037-8046 Appx8048-8059 Appx8060 Appx8063 Appx8069 Appx8070 Appx8073 Appx8075 Appx8077 Appx8080-8081 Appx8084-8088 Appx8090-8091 Appx8098-8101 Appx8104-8108 Appx8111-8112 Appx8115-8136 Appx8141-8153 Appx8155-8156 Appx8160-8162 Appx8165-8166 Appx8168-8169 Appx8171 Appx8173-8174 Appx8178-8183
Defendants' 2nd Supplemental Response to Plaintiffs' Interrogatories (Nos. 3)	2021-12-23	TX005	Appx8842-8878
WO2019139632A1	2019-07-18	TX013	Appx8879-8922
Text Message Conversation between A. Storms and B. Hakes		TX014	Appx8923-8994

Document Description	Date	Docket/ Exhibit No.	Appx Pages
Layer1 Claim Chart regarding U.S. Patent No. 10,608,433, Ex. H to Complaint (D.I. 1-8)(20-cv-00739) (exhibit as used at depositions)	2020-08-14	TX017	Appx9003-9028
Email from Austin Storms to Jason re Fwd: code with attachments PTX130 through PTX141	2019-04-29	TX020	Appx9061
denis_logic.py	2021-02-16	TX022	Appx9109
arb_main_AEC.py	2019-05-01	TX024	Appx9110
Message Report – Text messages between A. Storms and M. McNamara during May 4, 2019 through May 9, 2019	2019-05-04	TX052	Appx9137
Presentation, Lancium – Powering the Future of Computing	2019-08-19	TX091	Appx9234
Email from M. McNamara to R. Cline Fwd: Lancium Smart Response/September Thomas Road Power Reconciliation	2019-10-25	TX096	Appx9274
Email from M. McNamara to R. Cline re Thomas Road Power and attachments	2019-08-16	TX107	Appx9310-9312
Email from M. McNamara to R. Cline Re: ADK_LDI – Lancium LR Awards	2019-09-01	TX111	Appx9318
Initial Purchase Agreement between Lancium and Calpine for Thomas Road Facility		TX122	Appx9361-9362
PowerPoint - BTIG, Lancium Investor Presentation	2021-05-00	TX125	Appx9366-9411
5005.JPG (image with metadata)	2018-11-29	TX128	Appx9412-9413
5005.JPG (image with metadata)	2018-12-02	TX129	Appx9414-9415
5005.JPG (image with metadata)	2019-01-07	TX130	Appx9416-9417
IMG_0496.JPG (image with metadata)	2019-01-24	TX131	Appx9418-9419

Document Description	Date	Docket/ Exhibit No.	Appx Pages
IMG_0497.HEIC (image with metadata)	2019-01-24	TX132	Appx9420-9421
IMG_7517.jpeg (image with metadata)	2019-03-02	TX134	Appx9422-9423
57429304353__6E0371C9-75E8-44E8-A81D-AFBB30CF06BC.JPG (image with metadata)	2019-03-14	TX138	Appx9424-9425
57776007234__2BB185B5-C6C7-46CD-B355-A20A49854F4D.JPG (image with metadata)	2019-04-23	TX143	Appx9434-9435
Email from Austin Storms to Denis Labij re Day-ahead vs. RTBM LMP biz requirements and data questions with attachment (lmp_model_04252019.csv)	2019-04-24	TX146	Appx9444-9453
Email from Austin Storms to Denis Labij re Day-ahead vs. RTBM LMP biz requirements and data questions	2019-04-26	TX149	Appx9454-9455
Email from Austin Storms to Michael McNamara re BearBox 20' product details and supporting documentation with attachments (BearBox Product Details Summary v1.pdf; Permatron_Spec_Sheet.pdf; CamFil_Spec_Sheet.pdf; JandD_Spec_Sheet.pdf; exelon4_modeling_05092019.xlsx)	2019-05-09	TX157	Appx9631-9635
International Application Published Under PCT - WO 2019/139632 A1 Method and System for dynamic Power Delivery to a Flexible Datacenter Using Un-utilized Energy Sources	2019-07-05	TX163	Appx9711-9754
Patent Application File 162927119.pdf	2021-09-07	TX167	Appx11232-11363

Document Description	**Date**	**Docket/ Exhibit No.**	**Appx Pages**
BearBox_Product_Details_Summary _v1.pdf	2019-05-09	TX171	Appx11371-11372
Permatron_Spec_Sheet.pdf	2015-03-02	TX172	Appx11373
CamFil_Spec_Sheet.pdf	2018-12-08	TX173	Appx11374
JandD_Spec_Sheet.pdf	2019-04-01	TX174	Appx11375-11376
exelon4_modeling_05092019.xlsx	2019-05-09	TX175	Appx11377-11393
Email Lancium / SBI Update - Sept 27th	2018-09-27	TX176	Appx11394-11395
EDFR-Lancium_Hereford_Terms_Summar y_DRAFT_20180926.docx	2018-09-27	TX177	Appx11396-11400
Acciona_2018SEP19_Site_Visit.pdf	2018-09-20	TX178	Appx11401-11407
ServiceNow_Location_Entry.png		TX179	Appx11408-11409
Tier44_Power_Management_Dashb oard.png		TX180	Appx11410
Email Demo Day Script	2018-08-26	TX189	Appx11411-11412
Email Got it!	2018-06-28	TX190	Appx11413
Email Re: Other Thomas Investment	2018-10-12	TX222	Appx11567
dashboard_content.pptx	2018-10-11	TX223	Appx11568
Lancium Deck - I Squared v5_1IZ8uVYKObIZVDbZItnXEz-MJYT6wmTrr.pptx	2018-01-31	TX266	Appx11601 Appx11606
Email Re: Lancium (ADK_LD1) LR	2019-08-28	TX310	Appx11632-11638
Lancium_Control_Narrative_-_Draft_2019-05-01.pdf	2019-05-02	TX320	Appx11639 Appx11656-11658
Miner_Field_Ops_Kick_Off.pptx	2021-09-29	TX345	Appx11734
Email Re: 1803343 Lancium Data Box - Design Basis	2018-05-11	TX371	Appx11759
Email Re: Introductions	2017-12-05	TX372	Appx11766
Email Deck	2017-12-27	TX373	Appx11767
Lancium_Investor_Deck_Q118_v1.p ptx	2017-12-27	TX374	Appx11768-11796
Email LR DEMAND RESPONSE PRESENTATION 2019.pptx	2019-05-18	TX437	Appx11797
LR_DEMAND_RESPONSE_PRES ENTATION_2019.pptx	2019-05-17	TX438	Appx11807-11809

Document Description	Date	Docket/ Exhibit No.	Appx Pages
Email BAML deck	2018-03-29	TX462	Appx11817
Lancium_-_BAML_April_10th.pptx	2018-03-29	TX463	Appx11828
Email Countersigned EMS attached	2019-07-15	TX496	Appx12329
Countersigned_EMS_Lancium_071519.pdf	2019-07-15	TX497	Appx12337
Email Re: FW: Real-Time LMP	2019-04-22	TX501	Appx12342-12343
Email MP2 Demand Response	2019-08-27	TX526	Appx12344
Email Thomas Road Power	2019-08-16	TX567	Appx12348
Email Re: Checking / New Mexico Wind Energy Center	2018-02-07	TX594	Appx12350
Email Re: ADK_LD1 - Lancium LR Awards.xlsx	2019-09-04	TX595	Appx12352-12356
Email Re: ERS	2019-05-14	TX626	Appx12358
Email Re: LR DEMAND RESPONSE PRESENTATION 2019.pptx	2019-05-18	TX740	Appx12395-12396
Lancium_Introduction_and_Overview_-_May_2019.pdf	2019-05-08	TX741	Appx12397-12426
751f8045-9c06-4c58-b83f-f1d98c859e00.json		TX742	Appx12427-12428
Email Re: Meeting tomorrow	2019-05-06	TX748	Appx12431-12432
Lancium_Introduction_and_Overview_-_April_2019.pdf	2019-04-10	TX749	Appx12433-12462
Lancium_Standard_Mutual_NDA_.doc	2019-05-06	TX750	Appx12463-12465
Email Fwd:ERCOT Energy Curves Have Been Updated	2019-08-14	TX756	Appx12466-12468
Lancium_August_2019_Renewal_-_24_months.docx	2019-08-14	TX757	Appx12469-12471
Email Re: Calpine forecast for CP days	2019-08-05	TX758	Appx12472-12473
Weighted Average Cost of Energy (WACOE) - if you fix power at $33 and sell back at any price over $100.	2019-08-06	TX763	Appx12474
Lancium_Sellback_Sensitivity_Analysis.xlsx	2019-08-06	TX764	Appx12475-12478

Document Description	**Date**	**Docket/ Exhibit No.**	**Appx Pages**
Emails between Michael McNamara to Eric Kutscha, Jon Cohen, Raymond Cline attaching BearBox product details summary and specification sheets	2019-05-09	TX770	Appx12946
Email Jon Cohen to Michael McNamara	2018-10-16	TX781	Appx13030
Email from Austin Storms to Michael McNamara attaching BearBox product details summary and spec sheets	2019-05-09	TX887	Appx13323-13339
Storms Tweets - BearBox	11/1/2018 - 5/16/2019	TX901	Appx13353
Email from Austin Storms to Rajiv Patel and Michael Sacksteder attaching BearBox product details summary	2019-08-20	TX906	Appx13371-13396
Email from Austin Storms to Todd Garland Re: Fwd: EXELON DATA MODELING DUMP 2	2019-05-06	TX919	Appx13408-13409
Email from Austin Storms to Todd Garland with attachments Fwd: EXELON DATA MODELING DUMP 2	2019-05-03	TX920	Appx13411-13447
Email from Austin Storms to Ben Hakes attaching NDA Confidentiality Agreement	2018-12-10	TX932	Appx13450
Text message string	2020-08-03	TX957	Appx13565
Email chain between Dennis Labi, Austin Storms, Mike Hoadley, Chris Vickery, and Benjamin Hakes RE Day-ahead vs. RTBM LMP biz requirements and data questions	2019-04-25	TX962	Appx13566-13567
Lancium_Data_Box_-_Design_Basis_20180511_R3	2018-05-11	TX979	Appx13568-13569
Email re: ADK_LD1 - Lancium.xlsx	2019-08-26	TX981	Appx13570

Document Description	Date	Docket/ Exhibit No.	Appx Pages
ADK_LD1_-_Lancium.xlsx	2019-08-26	TX982	Appx13571
Curriculum Vitae of Frank McCamant			Appx13572-13576
Metadata for exelon4_modeling_05092019(1).xlsx		TX984	Appx13577-13586
Transcript of Telephonic Motion Hearing regarding Joint MOTION for Teleconference to Resolve Discovery Dispute; and Motion to Strike Amended Complaint	2022-04-22		Appx13647 Appx13653
Transcript of Markman Hearing	2022-10-20		Appx13804 Appx13821 Appx13828 Appx13835
Transcript of Pretrial Conference	2022-11-29		Appx13858-13876

Short Message Report

Conversations: 1	Participants: 3
Total Messages: 1033	Date Range: 12/5/2018 - 4/28/2021

Outline of Conversations

+19522203642 - 1033 messages between 12/5/2018 - 4/28/2021 - Austin Storms <+19853776257> - Austin Storms <austinmichael.storms@gmail.com> - Ben Hakes <+19522203642>

TX014
BearBox v. Lancium
21-cv-00534

Messages in chronological order (times are shown in GMT -05:00)

+19522203642

AS **Austin Storms <+19853776257>** 12/5/2018, 4:12 PM
Didn't forget about the one page, just been drowning over the last few days. When I get home tonight I'll put it all together and send something over

BH **Ben Hakes <+19522203642>** 12/5/2018, 4:14 PM
no worries - just whenever you can get to it

AS **Austin Storms <+19853776257>** 12/17/2018, 1:01 PM
Hey Ben, have you sent over that NDA yet? Haven't seen it and touching base.

A

AS **Austin Storms <+19853776257>** 12/18/2018, 3:07 PM
Call me when you get a chance. I've got a guy who can get us a meeting with Elon's gatekeeper for the load as a service renewables re: solar, Gigafactory, batteries, and the whole deal.

BH **Ben Hakes <+19522203642>** 12/18/2018, 8:53 PM
Hey - let me ring you tomorrow. Interested to hear more.

AS **Austin Storms <+19853776257>** 12/18/2018, 8:55 PM
Sure thing 👍

AS **Austin Storms <+19853776257>** 1/10/2019, 1:59 PM
So I've been working on an idea that ties together some of our ideas re: "load as a service," BearBox, mining pools, and some of the U.S. based exchanges.

BH **Ben Hakes <+19522203642>** 1/11/2019, 9:35 AM
You around later this afternoon? I've got a bit of a drive and could call you.

AS **Austin Storms <+19853776257>** 1/11/2019, 10:12 AM
Should be, just gimme a shout.

BH **Ben Hakes <+19522203642>** 1/11/2019, 10:12 AM
will do 👍

AS **Austin Storms <+19853776257>** 1/12/2019, 12:47 PM
Hey man, I got busy yesterday afternoon and didn't get a chance to call back before dinner - are you free any today?

BH **Ben Hakes <+19522203642>** 1/12/2019, 3:20 PM
No prob - not free today but am free tomorrow during the day

AS **Austin Storms <+19853776257>** 1/12/2019, 3:28 PM
Okay - tmrw at 11CST work?

Was in NYC at the end of the year hanging out with Marty - he's got some interesting ideas about Betterhash implemented by a pool instead of stratum, and it kind of ties everything together (LaaS, BearBox, renewables).

BH **Ben Hakes <+19522203642>** 1/12/2019, 7:06 PM
Ya that works. I'll be on the road but hit my cell up.

AS **Austin Storms <+19853776257>** 1/12/2019, 7:06 PM
Liked "Ya that works. I'll be on the road but hit my cell up."

AS **Austin Storms <+19853776257>** 1/25/2019, 2:24 PM
Wrote up the full management console for BearBox (working on some auto logic now). You said you're on the iOS track in Lambda, right?

*File "**b42b95b8-98ba-470c-a3e7-d2ff9dff7c82.HEIC**" is missing.*
Attachment: ~/Library/SMS/Attachments/0f/15/D5EB4D6D-540A-4C8E-8FE7-306533AF4284/IMG_0497.HEIC (2 MB)

BH **Ben Hakes <+19522203642>** 1/26/2019, 10:51 AM
Dude - that's sick. And yes! This would be super nice on mobile too.

BH **Ben Hakes <+19522203642>** 1/26/2019, 10:55 AM
This might be a fun project to work on during a build week.

AS **Austin Storms <+19853776257>** 1/26/2019, 10:57 AM
Absolutely. What you see there is 100% python - about 5,000 lines. I'll be testing the auto functionality once I finish the logic for it - gonna be slick.

BH **Ben Hakes <+19522203642>** 1/26/2019, 11:03 AM
Love it. I've got an iOS project ideas list going for when I get free time - this is going to move up near the top. I think in a month or so I get to pick what projects I work on. I'm more interested in commercial/industrial apps right now so this would be a perfect fit.

AS **Austin Storms <+19853776257>** 1/26/2019, 11:05 AM
Solid - I like the commercial industrial stuff too, it's practical and gets shit done.

BH **Ben Hakes <+19522203642>** 1/26/2019, 11:22 AM
Exactly.

AS **Austin Storms <+19853776257>** 2/5/2019, 5:32 PM
Yo Ben! Got time later this week to catchup on BearBox and LaaS?

BH **Ben Hakes <+19522203642>** 2/5/2019, 10:49 PM
Hey man - yes, let's catch up sometime on Friday afternoon 3:30-5 CT is open.

AS **Austin Storms <+19853776257>** 2/6/2019, 12:00 AM
Solid, I'll call you at 3:30 Friday

BH **Ben Hakes <+19522203642>** 2/6/2019, 3:36 PM
Liked "Solid, I'll call you at 3:30 Friday"

BH **Ben Hakes <+19522203642>** 2/8/2019, 4:27 PM
Mind if we push back 10 mins? I can call you.

AS **Austin Storms <+19853776257>** 2/8/2019, 4:28 PM
Sure thing omw home now

BH **Ben Hakes <+19522203642>** 2/8/2019, 4:28 PM
Sounds good

BH **Ben Hakes <+19522203642>** 2/8/2019, 5:54 PM
Talked to Dan (GP CEO), he said the FERC filings are going out today so we should be able to have substantive conversations with him Monday or Tuesday. I'm thinking of trying him in the afternoon Tuesday and looping you into the call - sounds like 100+ MW of wind for a couple of cents.

AS **Austin Storms <+19853776257>** 2/8/2019, 7:25 PM
Yea sounds great. Just lemme know when and I'll clear my sched

BH **Ben Hakes <+19522203642>** 2/8/2019, 7:56 PM
Liked "Yea sounds great. Just lemme know when and I'll clear my sched"

AS **Austin Storms <+19853776257>** 2/13/2019, 11:40 AM
https://www.theblockcrypto.com/2019/02/13/asic-chip-technology-is-renewable-energys-future/

*File **"2b40184b-8761-45f8-81ad-c170189595c3.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/df/15/464CE4E4-B8C0-417B-A32E-3079102B74E6/11F1CCFD-1E38-4CA6-8C1C-D3AC026D0A49.pluginPayloadAttachment (13 KB)

*File **"db582c83-73ad-4a19-8fa3-82e726b87887.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/66/06/D067E1E3-39E5-442B-9F9E-010EBC25D514/A992ED3D-B162-4DF5-926F-9BA0D50498BF.pluginPayloadAttachment (1 MB)

BH **Ben Hakes <+19522203642>** 2/14/2019, 7:57 PM
Yo - I was going to give Dan a ring tomorrow and talk a little more about the specific West Texas site they have and some of the requirements. My thought was to call around 2:30 CT. You around then?

BH **Ben Hakes <+19522203642>** 2/14/2019, 7:59 PM
Also, according to Dan, whichever party is the owner of the wind farm will also have to consume the power.

BH **Ben Hakes <+19522203642>** 2/14/2019, 8:08 PM
I.e., if I'm understanding what Dan is saying correctly, GlidePath would not send LAAS entity a bill for power.

BH **Ben Hakes <+19522203642>** 2/14/2019, 8:11 PM
Obviously this would need to be made up for in the form of a sort of lease payment.

AS **Austin Storms <+19853776257>** 2/14/2019, 8:20 PM
Yes can do 2:30 CST

AS **Austin Storms <+19853776257>** 2/14/2019, 8:20 PM
Have a lunch meeting at 1 but should be done by then

AS **Austin Storms <+19853776257>** 2/14/2019, 8:20 PM
I'll read the rest when I'm home and reply

BH **Ben Hakes <+19522203642>** 2/14/2019, 8:29 PM
Liked "I'll read the rest when I'm home and reply"

AS **Austin Storms <+19853776257>** 2/14/2019, 9:02 PM
Interesting with owner consumption req. - might have to get creative.

AS **Austin Storms <+19853776257>** 2/18/2019, 11:06 AM
Get a chance to clean up your model this weekend?

BH **Ben Hakes <+19522203642>** 2/18/2019, 11:39 AM
I started cleaning things up but then the weekend got away from me. Look for something later this evening. BTW, what's the best email to send files to?

AS **Austin Storms <+19853776257>** 2/18/2019, 11:39 AM
Same here - austin@bearbox.io is best

AS **Austin Storms <+19853776257>** 2/25/2019, 4:42 PM
Wanna walk through this spreadsheet with you when you get a chance - I've got a few questions on some things.

AS **Austin Storms <+19853776257>** 2/25/2019, 6:43 PM
Also LaaS is 100% viable as a business model re: Bitcoin mining, I've got a very reputable group who wants "off-grid"

electricity in the $.025/kWh range.

BH Ben Hakes <+19522203642> 2/25/2019, 6:44 PM
Liked "Wanna walk through this spreadsheet with you when you get a chance - I've got a few questions on some things."

BH Ben Hakes <+19522203642> 2/25/2019, 6:45 PM
How is your schedule looking tomorrow?

AS Austin Storms <+19853776257> 2/25/2019, 6:46 PM
Wide open, just working on some design stuff

BH Ben Hakes <+19522203642> 2/25/2019, 6:54 PM
cool - I'll try you sometime after 3 central

AS Austin Storms <+19853776257> 2/25/2019, 7:06 PM
Solid tty then

BH Ben Hakes <+19522203642> 2/26/2019, 3:57 PM
Getting swamped today - you around in the am tomorrow? Got an email from Dan asking about next steps.

AS Austin Storms <+19853776257> 2/26/2019, 3:59 PM
Yep - holler at me tmrw morning. Got a single 13.2kV to 416Y/240 transformer quote in - working on bulk pricing there.

Gotta figure out from Dan the exact infrastructure existing and what'd be required (above and beyond the pad mount transformers).

BH Ben Hakes <+19522203642> 2/26/2019, 4:00 PM
Noice.

AS Austin Storms <+19853776257> 2/26/2019, 4:00 PM
Working on some modeling for mining profitability through May 2020 as well - there's a decent model - but best is arb'ing power from $.02 to $.025, etc.

BH Ben Hakes <+19522203642> 2/26/2019, 4:01 PM
He's not going to know for sure but he can get the process moving.

BH Ben Hakes <+19522203642> 2/26/2019, 4:02 PM
We just have to come to him with a request for X MWs at $0.0X

BH Ben Hakes <+19522203642> 2/26/2019, 4:02 PM
Following, or not following the wind

BH Ben Hakes <+19522203642> 2/26/2019, 4:03 PM
Then he can go huddle with his team and see if they can get that done and what else they'd need to charge for.

BH Ben Hakes <+19522203642> 2/26/2019, 4:04 PM
Oh and we need to give him a sense for the amount of acres we need based on the MW request.

AS Austin Storms <+19853776257> 2/26/2019, 4:04 PM
We need the maximum capacity that's available by following the wind across the different sites. If that ends up as 35-40 MW out of a total 160 MW, I can fill it with Bitcoin miners at $.025 - $.0275

BH Ben Hakes <+19522203642> 2/26/2019, 4:05 PM
Whats the lead time on 2MW vs. 10MW vs. 40MW?

BH Ben Hakes <+19522203642> 2/26/2019, 4:07 PM
Is the longest lead time the miners or fabing the containers at that point?

AS **Austin Storms <+19853776257>** 2/26/2019, 4:07 PM
Transformer lead time is 10-12 weeks, shipping from S. Carolina.

AS **Austin Storms <+19853776257>** 2/26/2019, 4:08 PM
That's the longest - site prep is 2 weeks of line work and concrete for trans.

AS **Austin Storms <+19853776257>** 2/26/2019, 4:08 PM
3 BearBoxes every 8-10 weeks at 1 MW each

AS **Austin Storms <+19853776257>** 2/26/2019, 4:08 PM
So lead time for 3 MW is prob 14 weeks conservatively

AS **Austin Storms <+19853776257>** 2/26/2019, 4:09 PM
10 MW at 16-20 weeks maximum

AS **Austin Storms <+19853776257>** 2/26/2019, 4:10 PM
40 MW is 8-10 months depending on infra requirements on-site

BH **Ben Hakes <+19522203642>** 2/26/2019, 4:13 PM
How large a footprint for 3MW

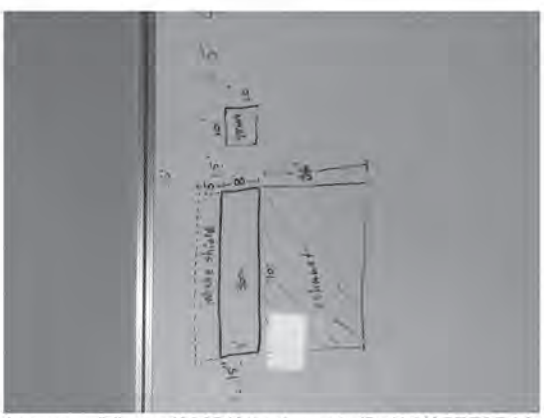
AS **Austin Storms <+19853776257>** 2/26/2019, 4:18 PM
.5 acres

AS **Austin Storms <+19853776257>** 2/26/2019, 4:19 PM
93' W x 207' L

BH **Ben Hakes <+19522203642>** 2/26/2019, 4:19 PM
not including the transformers?

AS **Austin Storms <+19853776257>** 2/26/2019, 4:20 PM
Including - actually 95'x209'

AS **Austin Storms <+19853776257>** 2/26/2019, 4:21 PM



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BH **Ben Hakes <+19522203642>** 2/26/2019, 4:24 PM
Ok cool

AS **Austin Storms <+19853776257>** 2/26/2019, 7:07 PM

What time you wanna setup a call tmrw morning? I'm good til 10am, then have a meeting with a structural engineer.

This project is going to move very fast once everyone's on the same page.

BH **Ben Hakes <+19522203642>** 2/26/2019, 7:53 PM
Let's talk at 9am

AS **Austin Storms <+19853776257>** 2/26/2019, 7:54 PM
Perfect, call you then.

AS **Austin Storms <+19853776257>** 2/28/2019, 5:23 PM
Yo! Did you call last night? Just saw I had a missed from you.

BH **Ben Hakes <+19522203642>** 2/28/2019, 5:24 PM
Haha ya sry - was in the car dialing a bunch of random people

BH **Ben Hakes <+19522203642>** 2/28/2019, 5:24 PM
I was gonna text you saying so, but then I thought, don't text and drive man.

AS **Austin Storms <+19853776257>** 2/28/2019, 5:24 PM
Laughed at "I was gonna text you saying so, but then I thought, don't text and drive man."

AS **Austin Storms <+19853776257>** 2/28/2019, 5:25 PM
I'm in bumper to bumper Mardi Gras traffic right now myself

AS **Austin Storms <+19853776257>** 2/28/2019, 5:25 PM
Wanna setup an intro call with you, me, Tom, and Todd Garland if you're up for it. Maybe Monday/Tuesday

BH **Ben Hakes <+19522203642>** 2/28/2019, 5:26 PM
Ha! Be safe my man! Yeah sounds good.

AS **Austin Storms <+19853776257>** 2/28/2019, 5:26 PM
Either day work better for you? Time?

BH **Ben Hakes <+19522203642>** 2/28/2019, 5:27 PM
Tuesday morning before 10a probably best otherwise Tuesday afternoon

AS **Austin Storms <+19853776257>** 2/28/2019, 5:28 PM
Okay I'll set it up and let you know

BH **Ben Hakes <+19522203642>** 2/28/2019, 5:30 PM
Liked "Okay I'll set it up and let you know "

AS **Austin Storms <+19853776257>** 2/28/2019, 5:43 PM
Tuesday morning 9-10 CST, Tom's getting us a conf line and I'll send over the details when I get them.

BH **Ben Hakes <+19522203642>** 2/28/2019, 5:46 PM
Sounds good - I'll look for that.

AS **Austin Storms <+19853776257>** 2/28/2019, 6:04 PM
Tue, Mar 5, 2019 10:00 AM - 10:30 AM EST

Please join my meeting from your computer, tablet or smartphone.
https://global.gotomeeting.com/join/485026109

You can also dial in using your phone.
United States: +1 (872) 240-3412 <tel:+18722403412,,485026109%23>

Access Code: 485-026-109

AS **Austin Storms <+19853776257>** 3/4/2019, 1:03 PM
Confirming our call tmrw morning @ 9CST

BH **Ben Hakes <+19522203642>** 3/4/2019, 2:32 PM
thanks - confirmed.

AS **Austin Storms <+19853776257>** 3/4/2019, 3:11 PM
Solid - Tom sent me some literature on Todd for us to look over. He's legit and the $$$ behind their project 1

AS **Austin Storms <+19853776257>** 3/4/2019, 3:11 PM
https://mixergy.com/interviews/buysellads-todd-garland-interview/

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BH **Ben Hakes <+19522203642>** 3/4/2019, 3:23 PM
Cool. Any idea on Tom's background? Is he the one managing the existing project?

AS **Austin Storms <+19853776257>** 3/4/2019, 4:26 PM
I'll ask him -

AS **Austin Storms <+19853776257>** 3/4/2019, 4:35 PM
https://www.linkedin.com/in/tommasiero

BH **Ben Hakes <+19522203642>** 3/4/2019, 4:36 PM
Liked "https://www.linkedin.com/in/tommasiero"

BH **Ben Hakes <+19522203642>** 3/4/2019, 4:38 PM
Are these the guys that were trying to sell to high-net worth individuals

AS **Austin Storms <+19853776257>** 3/4/2019, 5:17 PM
Yes - only accredited

AS **Austin Storms <+19853776257>** 3/4/2019, 5:18 PM
Got time for a 10 min call?

BH **Ben Hakes <+19522203642>** 3/4/2019, 5:20 PM
Ya call whenever

AS **Austin Storms <+19853776257>** 3/4/2019, 6:14 PM

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AS **Austin Storms <+19853776257>** 3/4/2019, 6:14 PM

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BH **Ben Hakes <+19522203642>** 3/4/2019, 7:04 PM
Emphasized a movie

BH **Ben Hakes <+19522203642>** 3/4/2019, 7:05 PM
Holy s***!!

AS **Austin Storms <+19853776257>** 3/4/2019, 7:06 PM
Dude it is absolute insanity on all accounts

BH **Ben Hakes <+19522203642>** 3/4/2019, 7:40 PM
Straight up Matrix rave

BH **Ben Hakes <+19522203642>** 3/4/2019, 7:46 PM
https://www.youtube.com/watch?v=FwbwEZtpEZU&feature=youtu.be

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BH **Ben Hakes <+19522203642>** 3/4/2019, 7:47 PM
^^ thought of this immediately

AS **Austin Storms <+19853776257>** 3/5/2019, 10:01 AM
Just hopped on the call

BH **Ben Hakes <+19522203642>** 3/5/2019, 10:01 AM
Me too

AS **Austin Storms <+19853776257>** 3/5/2019, 10:13 AM
Rejoining call

AS **Austin Storms <+19853776257>** 3/5/2019, 11:33 AM
Let's try and setup a call w Dan, Tom, Todd, you, and me ASAP

BH **Ben Hakes <+19522203642>** 3/6/2019, 10:38 AM
Floating it by them... will let you know.

AS **Austin Storms <+19853776257>** 3/6/2019, 10:40 AM
Liked "Floating it by them... will let you know."

BH **Ben Hakes <+19522203642>** 3/6/2019, 10:43 AM
if anything, hopefully the fact that someone is interested will increase engagement

AS **Austin Storms <+19853776257>** 3/6/2019, 10:49 AM
That's what I'm thinking as well - energy attracts energy

BH **Ben Hakes <+19522203642>** 3/6/2019, 10:50 AM
Tuning forks

AS **Austin Storms <+19853776257>** 3/6/2019, 10:50 AM

💯

BH Ben Hakes <+19522203642> 3/6/2019, 11:05 AM
can you give me a ball-park of the cost for ~12MWs on your end

BH Ben Hakes <+19522203642> 3/6/2019, 11:05 AM
need to get a sense of the check size were talking

AS Austin Storms <+19853776257> 3/6/2019, 11:09 AM
The 40' high cube containers for S9s and 12 MW total (without machines purchased) are ~$175k each - so $2.1m there.

Transformers are $22k each - $264k total.

BH Ben Hakes <+19522203642> 3/6/2019, 11:10 AM
how about with machines

AS Austin Storms <+19853776257> 3/6/2019, 11:11 AM
The 40' design is for 648 S9s - you might be able to get them for $150-200 each in bulk - so $130k max

BH Ben Hakes <+19522203642> 3/6/2019, 11:12 AM
so maybe ~$2.5-2.6 mil prior to site prep

BH Ben Hakes <+19522203642> 3/6/2019, 11:12 AM
?

AS Austin Storms <+19853776257> 3/6/2019, 11:13 AM
Yep - with the S9 or similar power draw (1,450w) machines.

AS Austin Storms <+19853776257> 3/6/2019, 11:14 AM
But realistically, I think the Whatsminer M10 is the best bet for mining post block subsidy halving at the end of May 2020.

AS Austin Storms <+19853776257> 3/6/2019, 11:15 AM
Those container are 1.5MW each and are ballparked at $220k each

AS Austin Storms <+19853776257> 3/6/2019, 11:15 AM
But machine costs are still too high around $850 per machine

BH Ben Hakes <+19522203642> 3/6/2019, 11:15 AM
so either buy s9s now then have to replace them post halving and take price risk on Whatsminer M10

BH Ben Hakes <+19522203642> 3/6/2019, 11:16 AM
or buy whatsminer M10 now

AS Austin Storms <+19853776257> 3/6/2019, 11:16 AM
I would negotiate hard on M10 pricing, otherwise you'll have to change PDUs, feeder breakers, etc.

AS Austin Storms <+19853776257> 3/6/2019, 11:17 AM
If we could get $500/M10, I'd do it all day, every day.

BH Ben Hakes <+19522203642> 3/6/2019, 11:17 AM
How many S9s for 12MW? vs. How many M10s for 12 MW?

AS Austin Storms <+19853776257> 3/6/2019, 11:19 AM
Containers
648*1400w for S9s
~600*2,100w for M10

AS **Austin Storms <+19853776257>** 3/6/2019, 11:19 AM
~8,000 S9s or 5,700 M10s

AS **Austin Storms <+19853776257>** 3/6/2019, 11:20 AM
116 PH/s vs 188 PH/s theoretically

BH **Ben Hakes <+19522203642>** 3/6/2019, 11:20 AM
okay cool

AS **Austin Storms <+19853776257>** 3/6/2019, 11:22 AM

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AS **Austin Storms <+19853776257>** 3/6/2019, 11:23 AM

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AS **Austin Storms <+19853776257>** 3/6/2019, 11:24 AM
Ballpark transformer quotes from Maddox - can pass on to Dan and his team to get any changes/required specs to infra on site - I think I remember him saying that turbine were primary voltage at 13.2kV

BH **Ben Hakes <+19522203642>** 3/6/2019, 11:26 AM
Liked "Ballpark transformer quotes from Maddox - can pass on to Dan and his team to get any changes/required specs to infra on site - I think I remember him saying that turbine were primary voltage at 13.2kV"

BH **Ben Hakes <+19522203642>** 3/6/2019, 11:26 AM
I think that's what he said.

BH **Ben Hakes <+19522203642>** 3/6/2019, 11:27 AM
I think it's more likely that they would pay those costs and then they would be charged back in the form of rent to LAAS

AS **Austin Storms <+19853776257>** 3/6/2019, 11:28 AM
Then those should work - I've got another few quote requests in to transformer companies, waiting to get the written quotes though.

Maddox has done work with some BTC miners before - the transformers will be "daisy chained"

AS **Austin Storms <+19853776257>** 3/6/2019, 11:28 AM

Liked "I think it's more likely that they would pay those costs and then they would be charged back in the form of rent to LAAS"

BH **Ben Hakes <+19522203642>** 3/7/2019, 9:58 AM

Couple of things you are welcome to communicate to Todd and Tom:

BH **Ben Hakes <+19522203642>** 3/7/2019, 9:59 AM

- I'm working on getting an NDA so as to facilitate a conversation between the two groups

BH **Ben Hakes <+19522203642>** 3/7/2019, 10:00 AM

- Dan's preference would be to skip the term sheet and go straight to contract

BH **Ben Hakes <+19522203642>** 3/7/2019, 10:02 AM

- They're not sure that 2 cents is "a dog that will hunt". They haven't told me an exact number but seems more like upper 2 cents to 3 cents is more realistic

BH **Ben Hakes <+19522203642>** 3/7/2019, 10:04 AM

- A high-level estimate of the uptime was done at the largest of the sites

BH **Ben Hakes <+19522203642>** 3/7/2019, 10:05 AM

AVG	23 MW
1 MW	76%
2 MW	73%
3 MW	71%
4 MW	69%
5 MW	67%
10 MW	60%
20 MW	47%

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AS **Austin Storms <+19853776257>** 3/7/2019, 10:08 AM

Will forward to Tom and Todd

AS **Austin Storms <+19853776257>** 3/7/2019, 10:09 AM

Is that a 23MW site with uptime per required load?

BH **Ben Hakes <+19522203642>** 3/7/2019, 10:09 AM

No I think it's more like a 70+ MW site.

BH **Ben Hakes <+19522203642>** 3/7/2019, 10:10 AM

But it is the uptime per required load, yes.

BH **Ben Hakes <+19522203642>** 3/7/2019, 10:15 AM
Lost you

AS **Austin Storms <+19853776257>** 3/8/2019, 3:03 PM
Any updates on NDA/phone conf?

BH **Ben Hakes <+19522203642>** 3/9/2019, 8:45 AM
Did you talk with them? I was gonna wait on the NDA/phone conf until we got there feedback on the high-level data and pricing. Just thought that they might not be interested at $0.0275 and maybe sub 10MW

AS **Austin Storms <+19853776257>** 3/9/2019, 9:21 AM
I just sent this to Tom - The wind farm isn't going to be feasible for the project you guys are doing. High level data is showing ~$0.26-0.275/kWh and variable uptime based on seasonality and wind patterns.

It might make sense down the road for individual container placements on sites with high uptime (90%+) and lower load (sub 2MW), but IMHO that's a longer timeline than what you guys are working to scale to pre-halving 2020.

Long story short: the HODL Ranch is a better business decision given all of the current data that's available to me - with the only exception being infrastructure mobility.

AS **Austin Storms <+19853776257>** 3/9/2019, 9:29 AM
I talked with him about it several days ago and was aware of the higher-level data but not the hard pricing at $.0275/kWh - that's going to make it hard to compete w/ projects like the HODL Ranch in Midland, TX - they're selling at $0.024/kWh on the deregulated Oncor grid w/ a private 110 MVA substation in phase 1.

I still don't like non-mobile infrastructure because operators have ~no recourse against utility companies/jurisdictional pressure, but some folks right now simply don't care about adversarially designing their infrastructure, i.e. a "decentralized" operation where the ~5-10% is spread amongst 20 different sites and geographic locations.

AS **Austin Storms <+19853776257>** 3/9/2019, 9:30 AM
that last one was just from me to you.

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:31 AM
Liked "I just sent this to Tom - The wind farm isn't going to be feasible for the project you guys are doing. High level data is showing ~$0.26-0.275/kWh and variable uptime based on seasonality and wind patterns.

It might make sense down the road for individual container placements on sites with high uptime (90%+) and lower load (sub 2MW), but IMHO that's a longer timeline than what you guys are working to scale to pre-halving 2020.

Long story short: the HODL Ranch is a better business decision given all of the current data that's available to me - with the only exception being infrastructure mobility."

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:32 AM
Liked "I talked with him about it several days ago and was aware of the higher-level data but not the hard pricing at $.0275/kWh - that's going to make it hard to compete w/ projects like the HODL Ranch in Midland, TX - they're selling at $0.024/kWh on the deregulated Oncor grid w/ a private 110 MVA substation in phase 1.

I still don't like non-mobile infrastructure because operators have ~no recourse against utility companies/jurisdictional pressure, but some folks right now simply don't care about adversarially designing their infrastructure, i.e. a "decentralized" operation where the ~5-10% is spread amongst 20 different sites and geographic locations."

AS **Austin Storms <+19853776257>** 3/9/2019, 9:37 AM
The trade off with HODL Ranch vs. any other renewable solution is adversarial infrastructure design re: diversifying operations across different geographic locations to withstand utility collusion and/or jurisdictional pressure.

Large scale projects typically receive a good bit of media attention and IMHO that's not a great thing in this industry - especially when the price of bitcoin goes back up and everyone's making money - and the local politicians, etc. want a bigger piece of the pie than was originally negotiated.

These are the types of things that I think about that some ppl simply don't consider. Just my $.02 (no pun intended).

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:37 AM
Let me know how they respond. Happy to keep the ball moving if there's still interest but also want to be sensitive to

GlidePath to not waste time on a lead that's not really interested.

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:38 AM

Liked "The trade off with HODL Ranch vs. any other renewable solution is adversarial infrastructure design re: diversifying operations across different geographic locations to withstand utility collusion and/or jurisdictional pressure.

Large scale projects typically receive a good bit of media attention and IMHO that's not a great thing in this industry - especially when the price of bitcoin goes back up and everyone's making money - and the local politicians, etc. want a bigger piece of the pie than was originally negotiated.

These are the types of things that I think about that some ppl simply don't consider. Just my $.02 (no pun intended)."

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:38 AM

Agreed. You'd pay something for that privacy.

AS **Austin Storms <+19853776257>** 3/9/2019, 9:38 AM

I agree - not trying to waste anybody's time here. Has GP sent you any detailed generation data?

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:39 AM

The goal is to be rich and unknown.

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:39 AM

Haha

AS **Austin Storms <+19853776257>** 3/9/2019, 9:39 AM

Loved "The goal is to be rich and unknown."

AS **Austin Storms <+19853776257>** 3/9/2019, 9:39 AM

That's always been my goal. I don't care about the fame, just the fortune.

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:40 AM

💯

BH **Ben Hakes <+19522203642>** 3/9/2019, 9:41 AM

I've requested the more detailed info... it needs to get dug out if a deal is to be done by any party. I'll bug them about it next week.

AS **Austin Storms <+19853776257>** 3/9/2019, 9:42 AM

Liked "I've requested the more detailed info... it needs to get dug out if a deal is to be done by any party. I'll bug them about it next week."

AS **Austin Storms <+19853776257>** 3/9/2019, 9:45 AM

We really just need hard numbers to see if it's feasible. Short-term, there will be better options than $0.0275/kWh, but that's still competitive long term.

We have to see if LaaS makes sense with reduced margin from $0.02 to $0.0275 as well - I'm sure it does at scale, but until then we have time and associated opportunity costs that I don't think either of us want to waste.

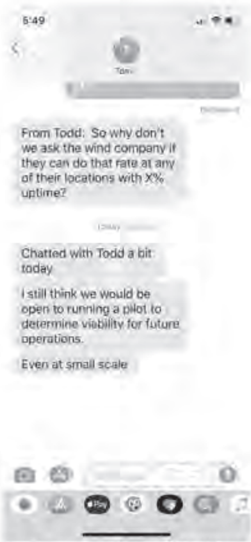
AS **Austin Storms <+19853776257>** 3/9/2019, 9:49 AM

I'm getting a sense of why Dan would want to keep this "in house" though - this is how I think anti-fragile "dark" mining pools will be run over the next 5+ years when jurisdictional pressure reaches a boiling point re: sovereign vs. non-sovereign currency and wealth.

AS **Austin Storms <+19853776257>** 3/9/2019, 9:50 AM

👆 and that has a lot of value if done correctly.

AS **Austin Storms <+19853776257>** 3/10/2019, 6:49 PM



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AS **Austin Storms <+19853776257>** 3/10/2019, 6:51 PM
From Tom earlier today - I haven't responded yet.

I previously told them that my opinion was HODL Ranch is their best option because of 90% uptime at $0.024/kWh and they're still interested in doing something small scale.

AS **Austin Storms <+19853776257>** 3/12/2019, 12:53 PM
Any word from Dan on data, etc?

BH **Ben Hakes <+19522203642>** 3/12/2019, 1:14 PM
Haven't heard back since last week - I'll follow up this afternoon

AS **Austin Storms <+19853776257>** 3/12/2019, 1:43 PM
Okay cool, just checking in.

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:19 AM
http://www.bostonblockchaincommunity.com/

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AS **Austin Storms <+19853776257>** 3/13/2019, 8:21 AM
Looks like a good event - there are really only two people on that list of speakers who are "qualified" to talk about mining - Steve and Dovey

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:25 AM
By the power vested in me by nobody I nominate you as speaker.

AS **Austin Storms <+19853776257>** 3/13/2019, 8:27 AM
Hahaha thanks, but they don't want me there.

I'm an old salty bitcoin Maximalist who'll douse Meltem's shitcoin portfolio in gasoline and light in on stage.

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:27 AM

BH Ben Hakes <+19522203642> 3/13/2019, 8:27 AM
Haha - that's great

BH Ben Hakes <+19522203642> 3/13/2019, 8:28 AM
Why have a conference about mining shitcoins?

AS Austin Storms <+19853776257> 3/13/2019, 8:29 AM
Idk - I expect Steve to be 100% Bitcoin, everyone else will waste time on alts.

Quantum's about to fire their team and hire me on part time to replace most of them out of their NOLA office - they have a big partnership with a hydro startup in upstate NY called Petawatt.

My one die-on-the-hill requirement was that we only mine BTC.

AS Austin Storms <+19853776257> 3/13/2019, 8:30 AM
Their main sales guy is Andrés - Canaan's rep from Venezuela who lives in Colombia/US now - we're about to have a big "in" to some of Canaan's secret sauce.

BH Ben Hakes <+19522203642> 3/13/2019, 8:30 AM
Liked "Idk - I expect Steve to be 100% Bitcoin, everyone else will waste time on alts.

Quantum's about to fire their team and hire me on part time to replace most of them out of their NOLA office - they have a big partnership with a hydro startup in upstate NY called Petawatt.

My one die-on-the-hill requirement was that we only mine BTC."

BH Ben Hakes <+19522203642> 3/13/2019, 8:31 AM
Sucks for their team but sounds awesome!

BH Ben Hakes <+19522203642> 3/13/2019, 8:32 AM
What's a hydro startup do?

AS Austin Storms <+19853776257> 3/13/2019, 8:32 AM
Yea, they were kind of all over the place (Denver, Austin, CT) - I told them 8 months ago that it would be an issue and it finally became one.

AS Austin Storms <+19853776257> 3/13/2019, 8:32 AM
Liked "What's a hydro startup do?"

BH Ben Hakes <+19522203642> 3/13/2019, 8:33 AM
I'm thinking of some silly "change the world" VC pitch... we're going to change the world one DAM at a time lol

BH Ben Hakes <+19522203642> 3/13/2019, 8:33 AM
Laughed at "Yea, they were kind of all over the place (Denver, Austin, CT) - I told them 8 months ago that it would be an issue and it finally became one."

AS Austin Storms <+19853776257> 3/13/2019, 8:33 AM
Same thing as LaaS - I read thru their private placement docs yesterday afternoon.

Exact. Same. Thing.

BH Ben Hakes <+19522203642> 3/13/2019, 8:34 AM
DAMN (pun slightly intended)

AS Austin Storms <+19853776257> 3/13/2019, 8:34 AM
HAHAHAHAHA

AS **Austin Storms <+19853776257>** 3/13/2019, 8:34 AM
Basically they're aggregating a portfolio of renewables starting in the St Lawrence seaway area

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:35 AM
Fuck that takes a lot of capital

AS **Austin Storms <+19853776257>** 3/13/2019, 8:35 AM
Selling to high load industries identified as bitcoin mining, cannabis hydroponic grow ops, etc.

AS **Austin Storms <+19853776257>** 3/13/2019, 8:35 AM
They're trying to raise $8M

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:35 AM
Oh that's not too bad

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:36 AM
I was thinking they were gonna buy the damns

AS **Austin Storms <+19853776257>** 3/13/2019, 8:36 AM
No, they're just brokering power and setting up infra

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:36 AM
Wow

AS **Austin Storms <+19853776257>** 3/13/2019, 8:36 AM
200MW phase 1, 340MW total after phase 2

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:36 AM
Fuck them

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:36 AM
^jking haha

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:37 AM
Dang that's some power

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:38 AM
hearing this makes me want to raise a $100 mil PE fund to go buy the actual assets

AS **Austin Storms <+19853776257>** 3/13/2019, 8:38 AM
LET'S FUCKING DO IT

AS **Austin Storms <+19853776257>** 3/13/2019, 8:39 AM
I told Quantum that I can only do 25 hours a week for them because I have BearBox and our project we're trying to put together.

AS **Austin Storms <+19853776257>** 3/13/2019, 8:40 AM
I'm a sustainable 80 hour/week kinda guy if I like what I'm doing.

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:40 AM
Play hard to get - always the right strategy

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:40 AM
Liked "I'm a sustainable 80 hour/week kinda guy if I like what I'm doing."

BH **Ben Hakes <+19522203642>** 3/13/2019, 8:40 AM
It's not work if you'd be doing it anyway, right?

AS **Austin Storms <+19853776257>** 3/13/2019, 8:49 AM
Loved "It's not work if you'd be doing it anyway, right?"

AS **Austin Storms <+19853776257>** 3/13/2019, 8:49 AM
Exactly - now I just get a part time gig to cover my bills so I can quit selling Bitcoin 😂

AS **Austin Storms <+19853776257>** 3/13/2019, 8:49 AM
Similar thing to what Marty did with the BuySellAds team

AS **Austin Storms <+19853776257>** 3/13/2019, 8:54 AM
This is the custom aluminum rack system that I've been working on for the past few weeks - finally done

*File **"1b8ac6ec-a5e9-4a20-af44-7ae23373c5bb.HEIC"** is missing.*
Attachment: ~/Library/SMS/Attachments/63/03/B395A106-ACAB-43CA-A1BF-E913B69AA627/IMG_1032.HEIC (2 MB)

*File **"233600cd-3150-4ca9-873d-c9db4eabcf81.HEIC"** is missing.*
Attachment: ~/Library/SMS/Attachments/62/02/C4F41395-02DD-49F7-B6E3-E48DE6E5AF99/IMG_1035.HEIC (3 MB)

BH **Ben Hakes <+19522203642>** 3/13/2019, 9:37 AM
Laughed at "Exactly - now I just get a part time gig to cover my bills so I can quit selling Bitcoin 😂 "

BH **Ben Hakes <+19522203642>** 3/13/2019, 9:37 AM
She's a beaut.

AS **Austin Storms <+19853776257>** 3/13/2019, 4:03 PM
Thanks dude. Reduced unused spaces to fit 40% more machines in the 20ft.

Was 192, now 272.

BH **Ben Hakes <+19522203642>** 3/13/2019, 9:39 PM
Incredible.

BH **Ben Hakes <+19522203642>** 3/13/2019, 9:40 PM
Packing some serious hashpower in a 20'

AS **Austin Storms <+19853776257>** 3/15/2019, 10:18 AM
Any updates from Dan or the GlidePath team?

BH **Ben Hakes <+19522203642>** 3/15/2019, 9:31 PM
Hey - just getting settled after a day of travel. I'm working through Dan's team for the data but they're saying it's going to take "longer". I didn't want to push over email so I'll need to call them, possibly follow up w/ Dan if I'm still stuck. They're claiming it's not available in as granular a form as we need. Gonna get to the bottom of it.

AS **Austin Storms <+19853776257>** 3/15/2019, 10:01 PM
Liked "Hey - just getting settled after a day of travel. I'm working through Dan's team for the data but they're saying it's going to take "longer". I didn't want to push over email so I'll need to call them, possibly follow up w/ Dan if I'm still stuck. They're claiming it's not available in as granular a form as we need. Gonna get to the bottom of it."

AS **Austin Storms <+19853776257>** 3/15/2019, 10:05 PM
All good, just checking in.

Tom and Todd from BuySellAds reached out again and are *still* interested in setting up a phone call w/ us and Dan.

AS **Austin Storms <+19853776257>** 3/15/2019, 10:07 PM
I'm < 24 hours from killing the deal from the Quantum team - I requested they put everything in an employee contract (two years of vesting, 6 month cliff, double trigger clause) and they balked, said they weren't putting that in writing 😂

AS **Austin Storms <+19853776257>** 3/15/2019, 10:12 PM
That being said, this industry is still full of super shady characters and I'm glad that you aren't one of them. ✌️

BH **Ben Hakes <+19522203642>** 3/16/2019, 8:00 AM
Liked "All good, just checking in.

Tom and Todd from BuySellAds reached out again and are *still* interested in setting up a phone call w/ us and Dan."

BH **Ben Hakes <+19522203642>** 3/16/2019, 8:00 AM
Emphasized "I'm < 24 hours from killing the deal from the Quantum team - I requested they put everything in an employee contract (two years of vesting, 6 month cliff, double trigger clause) and they balked, said they weren't putting that in writing 😂 "

BH **Ben Hakes <+19522203642>** 3/16/2019, 8:04 AM
Ugh, really? 😑 Sorry to hear that. And completely agree- I can't imagine the sketchy inbound you must get. I'll relay the information re: BSA's continued interest to Dan and GP.

AS **Austin Storms <+19853776257>** 3/16/2019, 8:59 AM
Liked "Ugh, really? 😑 Sorry to hear that. And completely agree- I can't imagine the sketchy inbound you must get. I'll relay the information re: BSA's continued interest to Dan and GP. "

AS **Austin Storms <+19853776257>** 3/16/2019, 9:02 AM
Yea, it's insane - always comes down to me saying "send the BTC" or "sign the contract" - most projects just want to offer long-term partnerships, pick my brain for 30 days, and then disappear.

It's why I had to start requiring consulting pay before I even got on a plane in 2017 🤷

AS **Austin Storms <+19853776257>** 3/16/2019, 9:03 AM
Thanks for keeping comms open with Dan and BSA - I know Dan previously mentioned that he's interested in more of a pilot with you and me, but I still think there's some value in having them at least talk.

BH **Ben Hakes <+19522203642>** 3/20/2019, 8:40 AM
Making a little headway on the data acquisition. Will keep you posted.

AS **Austin Storms <+19853776257>** 3/20/2019, 8:40 AM
Liked "Making a little headway on the data acquisition. Will keep you posted."

AS **Austin Storms <+19853776257>** 3/20/2019, 10:42 AM
Lmk when you get it and we can start analyzing - BSA guys just texted me and said HODL Ranch deal is dead, don't have any details atm.

AS **Austin Storms <+19853776257>** 3/22/2019, 12:50 PM
Still on for 1?

BH **Ben Hakes <+19522203642>** 3/22/2019, 12:51 PM
yup - talking with dennis and chris vickery - they're the guys on the power marketing/pricing side of GlidePath

AS **Austin Storms <+19853776257>** 3/22/2019, 12:58 PM
Liked "yup - talking with dennis and chris vickery - they're the guys on the power marketing/pricing side of GlidePath"

AS **Austin Storms <+19853776257>** 3/28/2019, 12:43 PM
About to email you the pricing and scope of work change estimates. Take a look at it when you can, LMK if you have any questions, then we can send to the guys at GlidePath in thread.

BH **Ben Hakes <+19522203642>** 3/28/2019, 12:44 PM

Was just about to check in - sounds great. Will look over during downtime this weekend.

BH Ben Hakes <+19522203642> 3/28/2019, 12:45 PM
Doing that Bitcoin presentation in Boston Monday night - small group but the Satoshi quote you recommended (..you might want to get some just in case it catches on..) is on the first page 😁

AS Austin Storms <+19853776257> 3/28/2019, 12:46 PM
Liked "Doing that Bitcoin presentation in Boston Monday night - small group but the Satoshi quote you recommended (..you might want to get some just in case it catches on..) is on the first page 😁"

AS Austin Storms <+19853776257> 3/28/2019, 12:46 PM
Excelente

AS Austin Storms <+19853776257> 3/28/2019, 12:46 PM
Just re-listened to Murad's interview on Pomp's podcast from last year as well - he makes some compelling arguments if you're still looking for some singers

AS Austin Storms <+19853776257> 3/28/2019, 12:46 PM
*zingers

BH Ben Hakes <+19522203642> 3/28/2019, 12:47 PM
probably a good idea - like I'm an athlete getting ready for the big game

BH Ben Hakes <+19522203642> 3/28/2019, 12:47 PM
headphones locked in

BH Ben Hakes <+19522203642> 3/28/2019, 12:50 PM
I'll probably just send a heads up to the GP folks that the response is coming sometime next week

AS Austin Storms <+19853776257> 3/28/2019, 12:53 PM
Liked "probably a good idea - like I'm an athlete getting ready for the big game"

AS Austin Storms <+19853776257> 3/28/2019, 12:53 PM
Liked "headphones locked in"

AS Austin Storms <+19853776257> 3/28/2019, 12:54 PM
It's pretty straight forward - 2 tab sheet with a summary pdf.

BH Ben Hakes <+19522203642> 3/28/2019, 12:55 PM
perfect

BH Ben Hakes <+19522203642> 3/29/2019, 10:09 AM
Hey - are you around New Orleans the next few days? Dan happens to be in town for the next couple of days it think.

AS Austin Storms <+19853776257> 3/29/2019, 10:43 AM
Yea I'll be here thru Wednesday

BH Ben Hakes <+19522203642> 3/29/2019, 10:44 AM
Great - you mind if I let Dan know i case he has down time

BH Ben Hakes <+19522203642> 3/29/2019, 10:44 AM
What part of the city are you in

AS Austin Storms <+19853776257> 3/29/2019, 10:45 AM
Sure thing. I live in the Warehouse District, a few blocks east from the Superdome

BH Ben Hakes <+19522203642> 3/29/2019, 10:46 AM

Great. I'll message him. No idea if he's got time but will let you know.

AS **Austin Storms <+19853776257>** 3/29/2019, 10:46 AM
Liked "Great. I'll message him. No idea if he's got time but will let you know."

BH **Ben Hakes <+19522203642>** 3/29/2019, 10:46 AM
Also just shot you a response.

BH **Ben Hakes <+19522203642>** 3/29/2019, 10:46 AM
To your email yesterday

AS **Austin Storms <+19853776257>** 3/29/2019, 10:51 AM
Looking at it now

BH **Ben Hakes <+19522203642>** 3/29/2019, 10:52 AM
Liked "Looking at it now"

BH **Ben Hakes <+19522203642>** 4/3/2019, 2:04 PM
You able to join this meeting?

AS **Austin Storms <+19853776257>** 4/3/2019, 2:05 PM
I've been on the line but you guys can't hear me, troubleshooting now

BH **Ben Hakes <+19522203642>** 4/3/2019, 2:05 PM
8666708282,,22358019#

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:14 AM
Yo was just thinking about this - it'd be super cool to write a little python script that ran on the UPS at the mining site that looked at the LMP (locational margin price) pricing at the grid node that the wind farm feed and power on/off based on whether or not the LMP is above or below, so $0.03/kWh

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:14 AM
https://marketplace.spp.org/file-api/download/rtbm-lmp-by-location?path=%2FRTBM-LMP-SL-latestInterval.csv

*File **"c9d36cf0-6bca-49ab-92ee-29f040bfd00d.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/c8/08/F270DCBF-8E67-42C7-9553-DCA6E0D0ADB4/0079B203-0E47-4D4B-B343-B7934C09E794.pluginPayloadAttachment (946 bytes)

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:15 AM
Seems pretty simple to prototype

AS **Austin Storms <+19853776257>** 4/5/2019, 8:18 AM
What is LMP? Should be pretty easy to incorporate anything if we have an accurate data feed in real time

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:19 AM
LMP is the price you get for delivering elections to a node on the grid

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:20 AM
LMPs are usually adjusted in 5-min increments

AS **Austin Storms <+19853776257>** 4/5/2019, 8:20 AM
Liked "LMPs are usually adjusted in 5-min increments"

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:20 AM
Electrons* not elections obvi

AS **Austin Storms <+19853776257>** 4/5/2019, 8:22 AM

That's what I needed to know. Basically just have to clean the format of the consumed data/API so I can add a function that calls and updates the SQLite tbl and does the logic

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:23 AM
Ya- so if you have a PPA I don't think you care about this...

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:23 AM
PPA is like a long term swap contract on that nodes LMP

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:24 AM
(We dont hear about this stuff b/c we mostly pay the retail rates)

AS **Austin Storms <+19853776257>** 4/5/2019, 8:26 AM
That makes sense - and LMP is measured in $/MW?

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:26 AM
Yup

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:27 AM
Also there's sometimes a thing called a Day-Ahead price, basically a day-ahead forward price that you could lock in

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:28 AM
Especially important if your operations take a while to get up and running (less so for mining)

AS **Austin Storms <+19853776257>** 4/5/2019, 8:28 AM
What's the process of locking in day ahead forward price?

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:29 AM
Think you call / request it with the ISO or grid operator

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:29 AM
https://www.iso-ne.com/markets-operations/markets/da-rt-energy-markets

*File **"a05da717-1592-418e-9084-721030c9b9e4.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/ef/15/9DCD58A7-CC43-4C98-8F90-52879012176B/66F5B523-E937-4E13-B0CF-F666EF63F4E5.pluginPayloadAttachment (1 KB)

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:31 AM
I think most of the negative pricing happens on the LMP

AS **Austin Storms <+19853776257>** 4/5/2019, 8:34 AM
Interesting. I'll see about incorporating the LMP data and checks into the current logic and do some unit testing.

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:36 AM
Cool. I like the pitch if you go to generation owners and say we won't mine over "X" price, so you don't lose out on juicy LMP pricing spikes.

AS **Austin Storms <+19853776257>** 4/5/2019, 8:38 AM
Absolutely! It's really good thinking - that way they can really maximize their profit.

AS **Austin Storms <+19853776257>** 4/5/2019, 8:39 AM
Tbh, that might be something we could develop a system for outside of the mining industry and for any other potential diverted power behind grid applications.

BH **Ben Hakes <+19522203642>** 4/5/2019, 8:43 AM
💯

BH Ben Hakes <+19522203642> 4/5/2019, 8:44 AM
Bitcoin enables real-time energy market trading.

AS Austin Storms <+19853776257> 4/5/2019, 8:45 AM
And has the ability to arb any inefficiencies in the production of excess for profit.

BH Ben Hakes <+19522203642> 4/5/2019, 8:45 AM
I mean, prior to this, you don't have a way to take advantage of weird market pricing anomolies in real time

BH Ben Hakes <+19522203642> 4/5/2019, 8:46 AM
Exactly

AS Austin Storms <+19853776257> 4/5/2019, 8:48 AM
And I don't think there's another application that's feasible for incremental monitoring on a 5 minute intervals

AS Austin Storms <+19853776257> 4/5/2019, 8:49 AM
Can you think or any?

BH Ben Hakes <+19522203642> 4/5/2019, 8:51 AM
No, all those data centers need 100% uptime to make sense. I guess if you're running the worlds largest SETI node or trying to find the next prime number

BH Ben Hakes <+19522203642> 4/5/2019, 8:51 AM
Lol

BH Ben Hakes <+19522203642> 4/5/2019, 8:54 AM
Trying to be an ETH full node maybe? Lol

AS Austin Storms <+19853776257> 4/5/2019, 11:36 AM
Laughed at "Trying to be an ETH full node maybe? Lol"

AS Austin Storms <+19853776257> 4/9/2019, 5:06 PM
LMP logic will work.

AS Austin Storms <+19853776257> 4/9/2019, 5:07 PM
And we should design and build something similar for estimating future on-chain transaction fees.

BH Ben Hakes <+19522203642> 4/10/2019, 9:53 PM
Liked "LMP logic will work."

BH Ben Hakes <+19522203642> 4/10/2019, 9:53 PM
That's sick

BH Ben Hakes <+19522203642> 4/10/2019, 9:55 PM
What data were you pulling it from? The one is sent? Would be sick to backtest it over a week or so, build out a mining /hashpower estimatation model to calculate revenue potential to GP.

BH Ben Hakes <+19522203642> 4/10/2019, 9:58 PM
Imagine going to someone and saying "yeah, what node are you feeding? We'll tell you how much money you could be making"

AS Austin Storms <+19853776257> 4/10/2019, 10:14 PM
Yea the link you sent - the data comes as a CSV, so I can fetch it at the top of every main() loop, auto-import to a SQLite table, and run logic against whichever metric we want in the data to send commands to the miners within the local IP range specified of the container.

AS Austin Storms <+19853776257> 4/10/2019, 10:19 PM

Did I tell you that I finished integrating the software side of monitoring/maintenance of cgminer with the PDUs?

So it's a fully automated, full hardware/software stack watchdog and sends an email on notification of cgminer restart, IO reboot, manual reboot required, etc.

AS **Austin Storms <+19853776257>** 4/10/2019, 10:19 PM

And uses about 25% of the system resources of a Raspberry pi going full throttle with .001 sec timeouts on host response.

It is absurd.

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:21 PM

Loved "Yea the link you sent - the data comes as a CSV, so I can fetch it at the top of every main() loop, auto-import to a SQLite table, and run logic against whichever metric we want in the data to send commands to the miners within the local IP range specified of the container."

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:21 PM

Emphasized "Did I tell you that I finished integrating the software side of monitoring/maintenance of cgminer with the PDUs?

So it's a fully automated, full hardware/software stack watchdog and sends an email on notification of cgminer restart, IO reboot, manual reboot required, etc. "

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:23 PM

That's insane.

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:28 PM

So wait, you can remote kill a a miner on a specific pdu?

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:28 PM

/ do a hard reset?

AS **Austin Storms <+19853776257>** 4/10/2019, 11:29 PM

Yes

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:29 PM

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:29 PM

Jeeze man. Lol.

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:31 PM

These things are going be so sick

AS **Austin Storms <+19853776257>** 4/10/2019, 11:32 PM

At the top of the watchdog loop, it'll import the CSV to a SQL table and check the LMP data against what our threshold price is in the logic, turn off the miners if LMP > threshold.

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:32 PM

You could arb any grid node and long as you had power and internet.

AS **Austin Storms <+19853776257>** 4/10/2019, 11:33 PM

Exactly

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:33 PM

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:37 PM

Now I'm wondering if there's some way to quickly get a power plant (wind, solar, etc) re-wired with the proper transformer

AS **Austin Storms <+19853776257>** 4/10/2019, 11:37 PM
And I think I could probably build the backend to change which miners were on based on power being generated

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:38 PM
Liked "And I think I could probably build the backend to change which miners were on based on power being generated"

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:38 PM
That'd be cool, take only the most power efficient miners possible.

BH **Ben Hakes <+19522203642>** 4/10/2019, 11:39 PM
Or maybe cycle them

AS **Austin Storms <+19853776257>** 4/10/2019, 11:46 PM
I meant on site - tie into real time generation data at average 500kW and ebb&flow miners on based on actual power generated so you don't brownout machines

AS **Austin Storms <+19853776257>** 4/10/2019, 11:46 PM
Does that make sense?

AS **Austin Storms <+19853776257>** 4/11/2019, 12:11 PM
Let's talk some about the LMP check when you get a chance - I think I can model profitability of mining with LMP logic over a week or so vs. just selling @ LMP.

If so, that's a game changer and we can develop it together to sell the system or full IP to the highest bidder.

AS **Austin Storms <+19853776257>** 4/11/2019, 12:19 PM
And realistically, the model will use on-site mining data with price API data to dynamically calculate at what LMP selling power back to the grid is more profitable than mining.

That's the real arb.

AS **Austin Storms <+19853776257>** 4/11/2019, 12:21 PM
^ this can realistically run on a raspberry pi @ < 35% system usage. One of the reasons I'm a Python maniac

BH **Ben Hakes <+19522203642>** 4/11/2019, 5:54 PM
Liked "Let's talk some about the LMP check when you get a chance - I think I can model profitability of mining with LMP logic over a week or so vs. just selling @ LMP.

If so, that's a game changer and we can develop it together to sell the system or full IP to the highest bidder."

BH **Ben Hakes <+19522203642>** 4/11/2019, 5:54 PM
Can you talk Friday morning?

BH **Ben Hakes <+19522203642>** 4/11/2019, 5:58 PM
Laughed at "^ this can realistically run on a raspberry pi @ < 35% system usage. One of the reasons I'm a Python maniac"

BH **Ben Hakes <+19522203642>** 4/11/2019, 5:59 PM
Liked "And realistically, the model will use on-site mining data with price API data to dynamically calculate at what LMP selling power back to the grid is more profitable than mining.

That's the real arb."

AS **Austin Storms <+19853776257>** 4/11/2019, 6:02 PM
Yea call me tmrw morning whenever. Going to do a track workout at 10, but free anytime before than.

BH **Ben Hakes <+19522203642>** 4/11/2019, 6:14 PM
Cool I'll try you around 9. You working out with your Saints buddies?

AS **Austin Storms <+19853776257>** 4/11/2019, 6:18 PM
Yep - gonna go to the high school with Mauti, run a bit, and meet the new head football coach and make sure he isn't a schmuck.

AS **Austin Storms <+19853776257>** 4/11/2019, 6:18 PM
Can't let just anybody seize the reins at our alma mater lol

BH **Ben Hakes <+19522203642>** 4/11/2019, 6:47 PM
Laughed at "Can't let just anybody seize the reins at our alma mater lol"

BH **Ben Hakes <+19522203642>** 4/11/2019, 6:48 PM
Lol. Solid. Alright I'll hit you up right at 9.

AS **Austin Storms <+19853776257>** 4/11/2019, 6:48 PM
Liked "Lol. Solid. Alright I'll hit you up right at 9."

AS **Austin Storms <+19853776257>** 4/12/2019, 4:23 PM
About to email the basic network watchdog to you - 77 lines of Python 😂

AS **Austin Storms <+19853776257>** 4/12/2019, 5:38 PM
Do you have a Bitcoin miner?

BH **Ben Hakes <+19522203642>** 4/12/2019, 8:15 PM
Liked "About to email the basic network watchdog to you - 77 lines of Python 😂 "

BH **Ben Hakes <+19522203642>** 4/12/2019, 8:17 PM
🙌 I really like Swift but I do miss Python. Staring it again in a week. I'll take a look.

No bitcoin miners here in Minnesota. I sold my Dragonmints when I left Chicago cuz electricity costs are $$$ here.

AS **Austin Storms <+19853776257>** 4/13/2019, 11:04 AM
Liked "🙌 I really like Swift but I do miss Python. Staring it again in a week. I'll take a look.

No bitcoin miners here in Minnesota. I sold my Dragonmints when I left Chicago cuz electricity costs are $$$ here."

AS **Austin Storms <+19853776257>** 4/17/2019, 12:09 PM
Is there anything the GP folks are waiting on from me? Or just LMP modeling Sarah

AS **Austin Storms <+19853776257>** 4/17/2019, 12:09 PM
data*?

BH **Ben Hakes <+19522203642>** 4/17/2019, 12:12 PM
Don't think so. They don't know about this LMP modeling thing. I think what we do is prep the modeling the go back to them with a check in and an update on some the work done on the LMP modeling

BH **Ben Hakes <+19522203642>** 4/17/2019, 12:14 PM
Like: "just wanted to check in and mention that we've been working on a way of integrating the LMPing into the mining operation"

AS **Austin Storms <+19853776257>** 4/19/2019, 8:04 PM

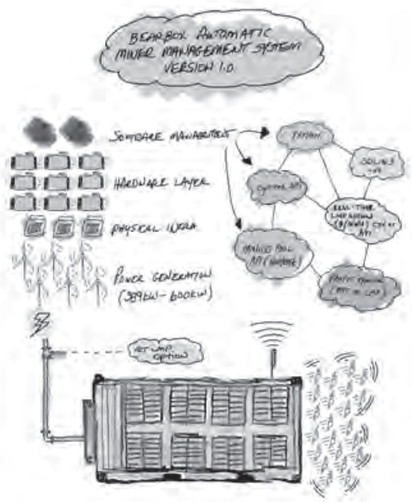


Image: ~/Library/SMS/Attachments/91/01/C9AA0DF2-CDE5-4FE9-9522-F884CCABD9BB/IMG_1394.JPG (447 KB)

AS **Austin Storms <+19853776257>** 4/19/2019, 8:06 PM
Putting together the data architecture for the model this weekend.

BH **Ben Hakes <+19522203642>** 4/20/2019, 1:29 PM
holy s***! that's cool

BH **Ben Hakes <+19522203642>** 4/20/2019, 1:29 PM
Loved an image

BH **Ben Hakes <+19522203642>** 4/20/2019, 1:30 PM
damn that is sexy

AS **Austin Storms <+19853776257>** 4/20/2019, 1:31 PM
Gonna email that to them with the data modeling once I figure it out

BH **Ben Hakes <+19522203642>** 4/20/2019, 1:32 PM
i love it

BH **Ben Hakes <+19522203642>** 4/20/2019, 1:33 PM
I can do a follow up with Mike next week, take their temperature on it

BH **Ben Hakes <+19522203642>** 4/20/2019, 1:34 PM
also, see if I can get a status update on timing

AS **Austin Storms <+19853776257>** 4/20/2019, 3:58 PM
Sounds good 👍

BH **Ben Hakes <+19522203642>** 4/22/2019, 1:06 PM
Talked with Mike - sounds like they are still hashing out the details of the real estate title transfer, and he said that we should definitely ping denis and Vickery (cc'ing Mike) if we have more material to share on the LMP API model/design

AS **Austin Storms <+19853776257>** 4/22/2019, 1:07 PM
For sure. I'll put together the tech arch/specs tonight and see how the model looks. I haven't sent an email to them yet.

BH **Ben Hakes <+19522203642>** 4/22/2019, 1:09 PM
Yup - I think it'll get the wheels turning on their end. If you can share that IMG I'm sure that'd catch some eyes

AS **Austin Storms <+19853776257>** 4/22/2019, 1:10 PM

Definitely - I still need to get clarification on real-time LMP vs. day-ahead LMP re: business requirements too.

BH **Ben Hakes <+19522203642>** 4/22/2019, 1:11 PM
Maybe that's a question to pose in that email as well...

AS **Austin Storms <+19853776257>** 4/22/2019, 1:15 PM
Yep, definitely. Will send out this afternoon when I get home, currently transitioning one of the permanent facilities.

AS **Austin Storms <+19853776257>** 4/23/2019, 11:56 AM
I'm running behind on some of the modeling - had an issue with an API that I'm working to fix.

AS **Austin Storms <+19853776257>** 4/23/2019, 11:57 AM
Also, real time LMP is big time volatile in the dataset I'm using - might just shoot an email over to the GP guys to see if they have a publicly facing csv or api for actual node data

BH **Ben Hakes <+19522203642>** 4/23/2019, 7:06 PM
Liked "I'm running behind on some of the modeling - had an issue with an API that I'm working to fix."

BH **Ben Hakes <+19522203642>** 4/23/2019, 7:06 PM
Liked "Also, real time LMP is big time volatile in the dataset I'm using - might just shoot an email over to the GP guys to see if they have a publicly facing csv or api for actual node data"

BH **Ben Hakes <+19522203642>** 4/23/2019, 7:07 PM
I can ask if you want. I'd probably direct it towards Denis and Vickery.

BH **Ben Hakes <+19522203642>** 4/23/2019, 7:08 PM
I think Denis will definitely know.

AS **Austin Storms <+19853776257>** 4/23/2019, 7:18 PM
I got the model running - gonna check it when I get home.

AS **Austin Storms <+19853776257>** 4/23/2019, 7:58 PM
This is one of the coolest things I've ever put together FYI - thanks for the idea.

Gonna let it run all night and analyze tmrw morning - it's real time LMP vs. network hashrate profitability in 5 min increments. Only one LMP price spike thus far.

Image: ~/Library/SMS/Attachments/2f/15/E4E986DE-8BFD-4F3B-A55C-0D0C3E164752/57776007234__2BB185B5-C6C7-46CD-B355-A20A49854F4D.JPG (5 MB)

BH **Ben Hakes <+19522203642>** 4/23/2019, 10:40 PM
Loved "This is one of the coolest things I've ever put together FYI - thanks for the idea.

Gonna let it run all night and analyze tmrw morning - it's real time LMP vs. network hashrate profitability in 5 min increments. Only one LMP price spike thus far."

BH Ben Hakes <+19522203642> 4/23/2019, 10:41 PM
Fascinating

BH Ben Hakes <+19522203642> 4/23/2019, 10:44 PM
So if you convert that`net_profit_BTC_5m` to dollars is that the dollar-for-dollar comparison to the real_time_LMP_mwh

BH Ben Hakes <+19522203642> 4/23/2019, 10:45 PM
No, looks like that's just the`net_profit_USD_5m`

AS Austin Storms <+19853776257> 4/23/2019, 10:46 PM
It's a bit of a misnomer

AS Austin Storms <+19853776257> 4/23/2019, 10:46 PM
Net profit USD 5m is BTC/USD value *over* the rt LMP pricing.

BH Ben Hakes <+19522203642> 4/23/2019, 10:48 PM
ok so you'd make about $3.50 every 5 mins in BTC, and you'd pay about $1.19

BH Ben Hakes <+19522203642> 4/23/2019, 10:48 PM
for the power

AS Austin Storms <+19853776257> 4/23/2019, 10:48 PM
Correct - the $1.19 is what the power would be sold back onto the grid for.

BH Ben Hakes <+19522203642> 4/23/2019, 10:49 PM
lol - freakin sweet

BH Ben Hakes <+19522203642> 4/23/2019, 10:49 PM
so you're real time calculating mining profitability

AS Austin Storms <+19853776257> 4/23/2019, 10:49 PM
So you could sell $1.19 of the BTC mined, cover normal rev, and then risk off the remainder.

They're going to want to lock in some of the cream in USD and risk a % of BTC on inventory.

BH Ben Hakes <+19522203642> 4/23/2019, 10:49 PM
at a particular node on the grid

AS Austin Storms <+19853776257> 4/23/2019, 10:50 PM
Yes yes yes

BH Ben Hakes <+19522203642> 4/23/2019, 10:50 PM
hahaha

AS Austin Storms <+19853776257> 4/23/2019, 10:50 PM
It's a license to print money

BH Ben Hakes <+19522203642> 4/23/2019, 10:51 PM
lol - beautiful

BH Ben Hakes <+19522203642> 4/23/2019, 10:51 PM
so that spike

BH Ben Hakes <+19522203642> 4/23/2019, 10:51 PM
miners would stop for that?

BH Ben Hakes <+19522203642> 4/23/2019, 10:52 PM

at 182

BH Ben Hakes <+19522203642> 4/23/2019, 10:52 PM
(I guess that assumes there's power at the wind farm)

AS Austin Storms <+19853776257> 4/23/2019, 10:53 PM
yep - could either loop over network range and stop cgminer or toggle relays on PDUs to turn everything off.

AS Austin Storms <+19853776257> 4/23/2019, 10:54 PM
takes the miners about 90 secs to reboot to hashing after being turned off.

BH Ben Hakes <+19522203642> 4/23/2019, 10:55 PM
So they start hashing when we come back off the 182 number to 34

AS Austin Storms <+19853776257> 4/23/2019, 10:56 PM
Yes - logic looks at net profit USD column

AS Austin Storms <+19853776257> 4/23/2019, 10:57 PM
Can config to either -/+ or set a threshold due to BTC price volatility.

BH Ben Hakes <+19522203642> 4/23/2019, 10:58 PM
Ya - I'm thinking you could have also have some ML in the python script that pattern matches the type of spike

BH Ben Hakes <+19522203642> 4/23/2019, 10:59 PM
like if the model thinks it's going to be a 60 min spike after a couple of observations, then you shut off

BH Ben Hakes <+19522203642> 4/23/2019, 10:59 PM
closer to your threshold

BH Ben Hakes <+19522203642> 4/23/2019, 10:59 PM
vs. like a 5 mins spike at $65 / MW

BH Ben Hakes <+19522203642> 4/23/2019, 11:00 PM
meh, maybe that's not worth it to shut down and chase

AS Austin Storms <+19853776257> 4/23/2019, 11:01 PM
Absolutely - weather has a lot to do with this rt LMP demand I believe.

I think SPP day ahead market LMP tries to smooth rt LMP volatility, but it kinda sucks at it tbh.

BH Ben Hakes <+19522203642> 4/23/2019, 11:02 PM
ya - that makes sense - so freakin cool!

BH Ben Hakes <+19522203642> 4/23/2019, 11:02 PM
I guess $0.06 is breakeven eh?

BH Ben Hakes <+19522203642> 4/23/2019, 11:03 PM
although sound like you think their is some funky business going on with the hash rate

AS Austin Storms <+19853776257> 4/23/2019, 11:04 PM
Yea, it's around $.06-.065 right now I think.

AS Austin Storms <+19853776257> 4/23/2019, 11:04 PM
And there's definitely something weird going on - was just talking with Miles about it.

AS Austin Storms <+19853776257> 4/23/2019, 11:05 PM
15% network hashrate just *disappeared* this morning while I was testing this. It scared the shit out of me because I

thought my modeling was wrong, entered everything manually, and then reran it.

Then checked it against some public unauth APIs and they weren't reporting the hashrate drop yet.

AS **Austin Storms <+19853776257>** 4/23/2019, 11:07 PM
A lot of people don't realize that hashrate is *estimated* based on network difficulty, expected blocks over 24hrs, and actually blocks over 24hrs.

Some were showing 51 exahash, some are still showing 45 Exahash - but it's 36 right now and was this morning.

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:12 PM
no blocks for the last half hour

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:12 PM
...obviously its stochastic

AS **Austin Storms <+19853776257>** 4/23/2019, 11:12 PM
I think manufacturers are artificially dropping hashrate to make new gen miner offerings look more "profitable" -

they make more money selling machines than self-mining, sell for BTC, more efficient machines decrease overall selling pressure from miners, BTC bull market comes, they make even_more_money.

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:14 PM
they won't be able to f* with the hash rate when those BearBoxes are just gonna arb that incremental power from the grid

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:14 PM
😬

AS **Austin Storms <+19853776257>** 4/23/2019, 11:15 PM
Hahaha whoever it was took 500-900MW offline in ~24 hours - they do what they want.

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:15 PM
But yeah dude - I don't trust those guys to do anything but what's in their best interest...

AS **Austin Storms <+19853776257>** 4/23/2019, 11:15 PM
Liked "But yeah dude - I don't trust those guys to do anything but what's in their best interest..."

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:16 PM
although the Jihan move was a real head scratcher

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:16 PM
maybe drunk on power

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:16 PM
or out of touch

AS **Austin Storms <+19853776257>** 4/23/2019, 11:16 PM
He started playing chess against himself and lost.

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:16 PM
Laughed at "He started playing chess against himself and lost."

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:17 PM
self-check mate

AS **Austin Storms <+19853776257>** 4/23/2019, 11:18 PM
Exactly. You don't play chess against yourself. In positions of power, nobody tells you that you're acting irrational. He

needed a "no man."

AS **Austin Storms <+19853776257>** 4/23/2019, 11:19 PM
Want me to send you these tables in CSV tmrw so you can dig thru it?

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:23 PM
Yah that'd be fun - shoot them over. I'd love to see another price spike or two - see what kinda juice you can squeeze outta that

AS **Austin Storms <+19853776257>** 4/23/2019, 11:24 PM
We had a bunch of spikes this am before I started logging, I'll let it run to lunch and email both over to you tmrw

AS **Austin Storms <+19853776257>** 4/23/2019, 11:25 PM
I've been writing code for like 15 hours though and I'm going to sleep hahaha tty tmrw

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:37 PM
Liked "I've been writing code for like 15 hours though and I'm going to sleep hahaha tty tmrw"

BH **Ben Hakes <+19522203642>** 4/23/2019, 11:37 PM
sounds good man ttys

AS **Austin Storms <+19853776257>** 4/24/2019, 11:45 AM
Something broke in the modeling script at 4 am... restarting it now. 😒

AS **Austin Storms <+19853776257>** 4/24/2019, 9:11 PM
Never mind, SPP pulled the real-time LMP CSV down from their site 🤔

BH **Ben Hakes <+19522203642>** 4/24/2019, 9:15 PM
Questioned "Never mind, SPP pulled the real-time LMP CSV down from their site 🤔"

BH **Ben Hakes <+19522203642>** 4/24/2019, 9:16 PM
Weird man

AS **Austin Storms <+19853776257>** 4/24/2019, 9:16 PM
Or they rate limited my IP..?

BH **Ben Hakes <+19522203642>** 4/24/2019, 9:16 PM
I think I'm gonna call Denis to see if they have a better source

BH **Ben Hakes <+19522203642>** 4/24/2019, 9:16 PM
Did you try through a VPN?

AS **Austin Storms <+19853776257>** 4/24/2019, 9:17 PM
I'm going to send an email tonight.

The CSV reappeared thru VPN and is now also appearing regularly.

Was hanging on a "no columns to parse error"

AS **Austin Storms <+19853776257>** 4/24/2019, 10:13 PM
Is GP aware of what I'm trying to do with LMP feeds?

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:15 PM
No - definitely not to the extent you're working with them now

AS **Austin Storms <+19853776257>** 4/24/2019, 10:15 PM
Okay. Just trying to figure out how to frame this email hahaha

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:16 PM
Sounds good - I can help provide further context in a follow up if necessary

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:17 PM
https://api.misoenergy.org/MISORTWD/lmpcontourmap.html

*File **"a9cca7d5-8c22-424b-9bcc-be28d282730d.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/aa/10/1D8668B0-5563-4C7E-AAB5-A4D788CB0074/69BE4911-4980-4714-8AB4-C7FE6B278468.pluginPayloadAttachment (85 KB)

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:17 PM
Didn't know MISO had this ^

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:19 PM
You've been pulling data from

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:19 PM
https://marketplace.spp.org

*File **"91ab2c5f-9837-4080-86c7-6e715b07cd20.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/99/09/C32ACD91-4CED-4580-B322-2696E0DD410D/4A63D3C3-C32C-41C9-9DDB-F2D14D0F059B.pluginPayloadAttachment (14 KB)

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:19 PM
Right?

AS **Austin Storms <+19853776257>** 4/24/2019, 10:20 PM
Yes - they have web UI or FTP for RTMB LMP

AS **Austin Storms <+19853776257>** 4/24/2019, 10:20 PM
The web UI has the CSV I've been requesting via the requests module

AS **Austin Storms <+19853776257>** 4/24/2019, 10:21 PM
Not sure how to hit the data point to query the FTP server yet - just found it like 20 mins ago

AS **Austin Storms <+19853776257>** 4/24/2019, 10:21 PM
MISO is nice - full JSON

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:22 PM
hmm

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:58 PM
Somewhat high level thought here but, I wonder if the Total Addressable Market of Load as a Service is basically the Congestion Component + Marginal Loss Component over all the nodes on the grid

BH **Ben Hakes <+19522203642>** 4/24/2019, 10:58 PM
https://www.pjm.com/-/media/training/nerc-certifications/markets-exam-materials/mkt-optimization-wkshp/locational-marginal-pricing-components.ashx?la=en

AS **Austin Storms <+19853776257>** 4/24/2019, 11:18 PM
Liked "Somewhat high level thought here but, I wonder if the Total Addressable Market of Load as a Service is basically the Congestion Component + Marginal Loss Component over all the nodes on the grid"

AS **Austin Storms <+19853776257>** 4/24/2019, 11:19 PM

Absolutely. We can provably determine the TAM of LaaS from that public marketplace data.

AS **Austin Storms <+19853776257>** 4/24/2019, 11:22 PM

And I think I figured out why my script was killing - I was running both models simultaneously (Antminer S9s and new gen) and they were both calling the same LMP_csv_import.py file drop then insert to the same lmp_data database table *within a sec of each other*

AS **Austin Storms <+19853776257>** 4/24/2019, 11:23 PM

Basically, the first one was inserting the records from the downloaded .csv and then running logic to model data tables while the second one was dropping the table that the first one was still using for model INSERT.

BH **Ben Hakes <+19522203642>** 4/25/2019, 9:02 AM

Liked "And I think I figured out why my script was killing - I was running both models simultaneously (Antminer S9s and new gen) and they were both calling the same LMP_csv_import.py file drop then insert to the same lmp_data database table *within a sec of each other*"

BH **Ben Hakes <+19522203642>** 4/25/2019, 9:02 AM

Liked "Basically, the first one was inserting the records from the downloaded .csv and then running logic to model data tables while the second one was dropping the table that the first one was still using for model INSERT."

AS **Austin Storms <+19853776257>** 4/25/2019, 9:59 AM

Just sent you an email with the CSV export from sql table. It ran all night - I'm going to leave it running for the next week or so.

AS **Austin Storms <+19853776257>** 4/25/2019, 5:21 PM

https://www.coindesk.com/bitfinex-ny-prosecutors-tether-850-million-allege

*File **"7c343e5c-214a-450b-8e76-d9fa8e90417b.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/b8/08/2E2C4C14-F10B-4925-AA06-3C3EECE9CB5E/57300EDD-1051-4048-B001-B8E76D15E94A.pluginPayloadAttachment (18 KB)

*File **"64e5d5db-fb2e-414a-b929-112bc92c50d0.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/68/08/98A83A53-9434-475D-9C68-4DA9D7966312/A6D770F9-873E-44F9-B67E-42AA5D1D088D.pluginPayloadAttachment (2 MB)

AS **Austin Storms <+19853776257>** 4/25/2019, 5:21 PM

Not bueno

BH **Ben Hakes <+19522203642>** 4/25/2019, 5:54 PM

Ugh yikes

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:03 PM

Upgraded my biz card game - thought you'd appreciate this one.

Image: ~/Library/SMS/Attachments/74/04/9954ECAB-DCE7-402C-B3E1-5C9E885523C7/57800828145__B4D33DA6-

6013-47FA-A834-40E1226E13EE.jpeg (4 MB)

AS **Austin Storms <+19853776257>** 4/26/2019, 5:04 PM
That's excellent

AS **Austin Storms <+19853776257>** 4/26/2019, 5:06 PM
I just figured out how to get all of the data in Denis' email without have portal credentials and fetching from the marketplace FTP server.

Working on integrating with my bitcoin full node to fetch blocks on loop and calculating estimate hashrate locally rather than relying on API data.

Building the future.

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:06 PM
Laughed at "I just figured out how to get all of the data in Denis' email without have portal credentials and fetching from the marketplace FTP server.

Working on integrating with my bitcoin full node to fetch blocks on loop and calculating estimate hashrate locally rather than relying on API data.

Building the future.
"

AS **Austin Storms <+19853776257>** 4/26/2019, 5:06 PM
How's Lambda going? How much longer until you grad?

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:06 PM
That's awesome - you'll have to tell me about that workaround

AS **Austin Storms <+19853776257>** 4/26/2019, 5:08 PM
It's all available in CSVs, you just have to format string value in the url request to increment with the calendar for the day ahead market LMP - which is currently at $4/MWH 😂

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:09 PM
Laughed at "It's all available in CSVs, you just have to format string value in the url request to increment with the calendar for the day ahead market LMP - which is currently at $4/MWH 😂"

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:09 PM
$$$$

AS **Austin Storms <+19853776257>** 4/26/2019, 5:09 PM
And I figured out breakeven calcs last night - easy to integrate that logic as well once I have the local estimated hashrate

File ***"b92ee952-02ab-4c2c-b018-f6bd213049e2.HEIC"*** *is missing.*
Attachment: ~/Library/SMS/Attachments/cb/11/05861ECF-1D51-4754-9F9E-73DA9681E1DD/IMG_1453.HEIC (1 MB)

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:09 PM
That's amazing

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:10 PM
I'm just gonna reorder those biz cards for you and slap a bear box logo on it

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:10 PM
Lol so cool

AS **Austin Storms <+19853776257>** 4/26/2019, 5:10 PM
Laughed at "I'm just gonna reorder those biz cards for you and slap a bear box logo on it"

AS **Austin Storms <+19853776257>** 4/26/2019, 5:10 PM
Do itttttt

AS **Austin Storms <+19853776257>** 4/26/2019, 5:10 PM
BearBox trademark application is actually being opposed right now by the university of Montana - they just filed an extension to oppose, which is super weird.

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:11 PM
"Bitcoin will ultimately be calculated based on the kWh"

AS **Austin Storms <+19853776257>** 4/26/2019, 5:11 PM
Loved ""Bitcoin will ultimately be calculated based on the kWh""

AS **Austin Storms <+19853776257>** 4/26/2019, 5:11 PM
100%

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:12 PM
*Calculated and priced

AS **Austin Storms <+19853776257>** 4/26/2019, 5:13 PM
Bitcoin doesn't know what dollars are, only hashes, and the machines only know watts.

USD is external to the system.

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:14 PM
That we don't think about money like a technology that can be improved, refined is very under appreciated

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:16 PM
Bitcoin is much closer to a pure unit like the centimeter, kg, watt, than dollars

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:16 PM
Peeps just don't think about it like this

AS **Austin Storms <+19853776257>** 4/26/2019, 5:17 PM
Because it *can't* be manipulated and 1 BTC is always 1 BTC.

AS **Austin Storms <+19853776257>** 4/26/2019, 5:17 PM
That's why inflation narratives are hot garbage.

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:22 PM
Loved "That's why inflation narratives are hot garbage. "

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:23 PM
MMTs à crack-pipe phenomenon

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:24 PM
Oh ya and officially done with lambda by the 4th of July

AS **Austin Storms <+19853776257>** 4/26/2019, 5:24 PM
The economists are simply out of options.

The old ones are dying and the young ones realized they've inherited a system that's too broken to fix.

AS **Austin Storms <+19853776257>** 4/26/2019, 5:25 PM
Loved "Oh ya and officially done with lambda by the 4th of July"

AS **Austin Storms <+19853776257>** 4/26/2019, 5:25 PM
INDEPENDENCE DAY LFG

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:25 PM
LFGGG

AS **Austin Storms <+19853776257>** 4/26/2019, 5:26 PM
Where do you want to work?

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:26 PM

Image: ~/Library/SMS/Attachments/51/01/EA5FE66B-BB75-4D66-80C9-D17D417DAA74/ms-Gvil3S.gif (466 KB)

AS **Austin Storms <+19853776257>** 4/26/2019, 5:26 PM
Tom Brady is my Fortnite skin when I'm really bored and I login to crush 10 year olds.

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:26 PM
Lol

AS **Austin Storms <+19853776257>** 4/26/2019, 5:27 PM
I'm going to finish this software and let's raise a round to buy underutilized generation assets and arb out BTC.

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:28 PM
Work wise: as small of a shop as possible.

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:28 PM
Loved "I'm going to finish this software and let's raise a round to buy underutilized generation assets and arb out BTC."

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:28 PM
LFG man

AS **Austin Storms <+19853776257>** 4/26/2019, 5:29 PM
I'm 100% about it

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:29 PM

Image: ~/Library/SMS/Attachments/01/01/ED6A9981-EA6A-4330-A623-98312461DBA2/ms-CG445E.gif (89 KB)

AS **Austin Storms <+19853776257>** 4/26/2019, 5:31 PM
Tbh, if I get this model correct it's going to be *wild*

AS **Austin Storms <+19853776257>** 4/26/2019, 5:31 PM
I don't know of anybody else in bitcoin who's doing anything like this from the LaaS perspective

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:31 PM
It's so cool man. I just can't get over the fact you're real time pricing grid nodes.

AS **Austin Storms <+19853776257>** 4/26/2019, 5:32 PM
It's really not that complicated - I imagine most people aren't aware this problem even exists.

AS **Austin Storms <+19853776257>** 4/26/2019, 5:33 PM
And the people who are aware have no idea about bitcoin hahahaha

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:33 PM
I wonder if juxtaposing BearBox vs. batteries would be an interesting marketing/sales angle

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:34 PM
Like like look at who's buying batteries in significant quantities and why

AS **Austin Storms <+19853776257>** 4/26/2019, 5:35 PM
Like why use batteries when you can store the electricity in a global, highly-liquid digital asset? 😂

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:36 PM
It'd be good to compare BearBox on cost per installed mega watt perspective

AS **Austin Storms <+19853776257>** 4/26/2019, 5:36 PM
I think big players will want to hedge volatility by selling BTC mined IRT + x% = what revenue would've been at LMP pricing… and hold some as inventory.

AS **Austin Storms <+19853776257>** 4/26/2019, 5:36 PM
Emphasized "It'd be good to compare BearBox on cost per installed mega watt perspective "

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:36 PM
Similar to the way batteries are priced I pretty certain

AS **Austin Storms <+19853776257>** 4/26/2019, 5:37 PM
I didn't even think of that.

BH **Ben Hakes <+19522203642>** 4/26/2019, 5:38 PM
Ya I think it's like a $mil for a MW battery, at least, and that's just moving time around

AS **Austin Storms <+19853776257>** 4/26/2019, 5:38 PM
^ exactly

AS **Austin Storms <+19853776257>** 4/26/2019, 5:38 PM
And when batteries are full but LMP price is still negative, what happens?

AS **Austin Storms <+19853776257>** 4/26/2019, 5:40 PM
Idk how batteries would work from an electrical perspective - I guess they have high voltage ones that can charge off of a 13.2KV bus?

BH **Ben Hakes <+19522203642>** 4/26/2019, 6:10 PM
Me either but I know that there's something called a "c-rate" which normalizes the batteries discharge against its capacity

BH Ben Hakes <+19522203642> 4/26/2019, 6:11 PM
A 1 MWh, 1 C bat can discharge a MW for an hour.

BH Ben Hakes <+19522203642> 4/26/2019, 6:12 PM
"High C-rate" batteries can be incredibly expensive

BH Ben Hakes <+19522203642> 4/26/2019, 6:12 PM
http://web.mit.edu/evt/summary_battery_specifications.pdf

AS Austin Storms <+19853776257> 4/26/2019, 9:13 PM
I'll check them out.

AS Austin Storms <+19853776257> 4/26/2019, 9:13 PM
I fell asleep earlier - do you run a bitcoin full node?

BH Ben Hakes <+19522203642> 4/26/2019, 10:04 PM
Had one running on an Intel NUC after of got to MN but since got a little paranoid about leaking too much IP info so I've shelved it for now

AS Austin Storms <+19853776257> 4/26/2019, 10:05 PM
Liked "Had one running on an Intel NUC after of got to MN but since got a little paranoid about leaking too much IP info so I've shelved it for now"

AS Austin Storms <+19853776257> 4/26/2019, 10:06 PM
Yea I wish the core implementation had Tor by default tbh

AS Austin Storms <+19853776257> 4/26/2019, 10:06 PM
But messes with propagation times tmk

AS Austin Storms <+19853776257> 4/27/2019, 3:40 PM
You have a github username?

BH Ben Hakes <+19522203642> 4/27/2019, 3:41 PM
Bhakes

AS Austin Storms <+19853776257> 4/27/2019, 3:41 PM
Just sent you an invite to a private repo

AS Austin Storms <+19853776257> 4/27/2019, 3:45 PM
Dumped the local block height/ propagation script in there, gonna start moving some stuff over to it that I thought you might be interested in.

BH Ben Hakes <+19522203642> 4/28/2019, 1:18 PM
Sweet - will definitely check this out today

AS Austin Storms <+19853776257> 4/28/2019, 1:20 PM
Excellent. The propagation calcs were wrong(?) evidently, so I edited them out for the time being.

Getting with Felix Weis to figure out how it should exactly work.

AS Austin Storms <+19853776257> 4/29/2019, 9:28 AM

*File **"0e3e09f0-d7dd-439e-88eb-476f751931ee.HEIC"** is missing.*
Attachment: ~/Library/SMS/Attachments/fe/14/C5D16809-A1A5-42EB-90F9-49E696558ECD/IMG_1489.HEIC (3 MB)

AS Austin Storms <+19853776257> 4/29/2019, 9:29 AM

It's done. Logging all data now (S9 and new gen sets) and running logic control in real time on a miner in my apartment.

AS **Austin Storms <+19853776257>** 4/29/2019, 9:29 AM

Image: ~/Library/SMS/Attachments/10/00/A69B6F36-13C4-4B06-9254-74AC59C9F2CB/57824098684__859EA2F7-67C3-47BD-ACD4-F61EB4E87EB5.JPG (2 MB)

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:00 PM
Laughed at an image

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:00 PM
Liked "It's done. Logging all data now (S9 and new gen sets) and running logic control in real time on a miner in my apartment."

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:00 PM
How are the test running?

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:01 PM
Actually had to get my python environment up to 3.7.3 for Lambda today

AS **Austin Storms <+19853776257>** 4/29/2019, 10:02 PM
It's excellent - saw my first RT LMP spike earlier today and just had a few when I got home.

Can send you the data if you want to take a look.

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:02 PM
Ya that'd be sweet

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:03 PM
How much did she spike to?

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:03 PM
$/kWh?

AS **Austin Storms <+19853776257>** 4/29/2019, 10:03 PM
The first was around .085/kWh

AS **Austin Storms <+19853776257>** 4/29/2019, 10:05 PM
The last few were between ~.32/kWh and .825/kWh

AS **Austin Storms <+19853776257>** 4/29/2019, 10:14 PM
Miner kicked off the entire time - got the slushpool update, but had an error in one of my email functions that kicks the alert that they turned off bc I forgot to pass a param to it.

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:16 PM
0.32 correct?

AS **Austin Storms <+19853776257>** 4/29/2019, 10:16 PM
Yea - $320/MWH lol

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:16 PM
$0.32-0.825 /kWh

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:16 PM
Lol okay i was gonna say crap

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:17 PM
Loved "Miner kicked off the entire time - got the slushpool update, but had an error in one of my email functions that kicks the alert that they turned off bc I forgot to pass a param to it."

AS **Austin Storms <+19853776257>** 4/29/2019, 10:17 PM
That's a huge spike - LMP data for the past two days has been in the $15-20/MWH range

AS **Austin Storms <+19853776257>** 4/29/2019, 10:17 PM
BTC mining breakeven for S9 gen miners is around $80/MWH

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:17 PM
That's cool man - so obvi this is running based off of the node in the Texas panhandle?

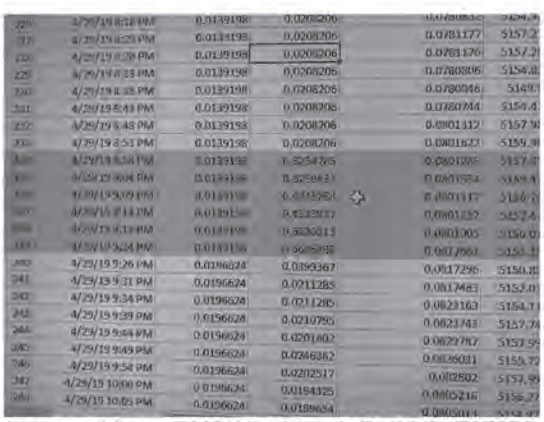
AS **Austin Storms <+19853776257>** 4/29/2019, 10:18 PM
Yes

BH **Ben Hakes <+19522203642>** 4/29/2019, 10:18 PM
How long are the spikes lasting?

AS **Austin Storms <+19853776257>** 4/29/2019, 10:19 PM
The first one was $85/MWh for a single 5 min increment, then it dropped under the breakeven for 10 mins and went to $107/MWH for a 5 min increment

AS **Austin Storms <+19853776257>** 4/29/2019, 10:20 PM
The second one went from $325/MWH, up to $825/MWH, and then in the $400-670 range and last for 30 minutes straight

AS **Austin Storms <+19853776257>** 4/29/2019, 10:21 PM



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240	4/29/19 9:26 PM	0.0196624	0.0399367	0.0817296	[illegible]
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242	4/29/19 9:34 PM	0.0196624	0.0211285	0.0823163	5154.1
243	4/29/19 9:39 PM	0.0196628	0.0210795	0.0823743	5157.7
244	4/29/19 9:44 PM	0.0196624	0.0201802	0.0829787	5157.5
245	4/29/19 9:49 PM	0.0196624	0.0246382	0.0826031	5155.72
246	4/29/19 9:54 PM	0.0196624	0.0202517	0.082802	5157.9
247	4/29/19 10:00 PM	0.0196624	0.0194325	0.0805216	5156.27
248	4/29/19 10:05 PM	0.0196624	0.0189634	[illegible]	[illegible]

Image: ~/Library/SMS/Attachments/3c/12/C0FA73B2-99EE-43B7-BAF7-2CFDBE1ED7B7/57828725805__5B2585EF-511D-43A9-AFFC-5E148F711517.JPG (7 MB)

AS **Austin Storms <+19853776257>** 4/29/2019, 10:21 PM
Day ahead LMP, then real time LMP, then breakeven mining $/kWh

AS **Austin Storms <+19853776257>** 4/30/2019, 10:11 AM
Going to Boston this weekend for the mining summit at Fidelity - should be interesting to see what everyone's actually doing.

Gonna poke around and figure out if anyone else is doing what we're working on.

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:16 AM
Loved "The second one went from $325/MWH, up to $825/MWH, and then in the $400-670 range and last for 30 minutes straight"

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:16 AM
The 5 mins spikes are tough but the 30 min is long enough to stop mining for sure

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:17 AM
Loved "Going to Boston this weekend for the mining summit at Fidelity - should be interesting to see what everyone's actually doing.

Gonna poke around and figure out if anyone else is doing what we're working on."

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:17 AM
That's awesome. Haha can you periscope me into that? Maybe I should make a quick trip to visit my in-laws

AS **Austin Storms <+19853776257>** 4/30/2019, 10:19 AM
Flights are super cheap - I literally just booked it.

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:19 AM
(technically not "in laws" yet but)

AS **Austin Storms <+19853776257>** 4/30/2019, 10:19 AM
Laughed at "(technically not "in laws" yet but)"

AS **Austin Storms <+19853776257>** 4/30/2019, 10:19 AM
Time is a flat circle.

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:19 AM
It's a process

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:19 AM
Laughed at "Time is a flat circle."

AS **Austin Storms <+19853776257>** 4/30/2019, 10:21 AM
Does her dad own BTC yet?

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:22 AM
haha - I gave him some one time when he drove us to the airport... that was at $9k

AS **Austin Storms <+19853776257>** 4/30/2019, 10:22 AM
Hahahahahahahaha

BH **Ben Hakes <+19522203642>** 4/30/2019, 10:23 AM
He's a Mass District Attorney - safe to say he's skeptical but I'm workin on him

AS **Austin Storms <+19853776257>** 4/30/2019, 10:23 AM
I gave my brother one for his wedding @ $5k and told him to HODL through the $20k spike.

He was not happy w me.

AS Austin Storms <+19853776257> 4/30/2019, 10:23 AM
Liked "He's a Mass District Attorney - safe to say he's skeptical but I'm workin on him"

BH Ben Hakes <+19522203642> 4/30/2019, 11:07 AM
Laughed at "I gave my brother one for his wedding @ $5k and told him to HODL through the $20k spike.

He was not happy w me."

AS Austin Storms <+19853776257> 5/1/2019, 12:24 PM
When can you review some of this data and the code with me? Want to move fast with GP and either sell the IP to them, another entity that's generating, or work to raise a round.

BH Ben Hakes <+19522203642> 5/1/2019, 1:33 PM
Can you talk tomorrow morning? Maybe around 9am central?

BH Ben Hakes <+19522203642> 5/1/2019, 1:33 PM
I'd like to follow up with GP as well

AS Austin Storms <+19853776257> 5/1/2019, 2:01 PM
I've got a 8am flight to Boston, but land there at 3pm. Can do after that or very early Friday morning.

BH Ben Hakes <+19522203642> 5/1/2019, 3:02 PM
Let's talk now - call me when you can

AS Austin Storms <+19853776257> 5/1/2019, 3:03 PM
Gimme about 30-45 mins

AS Austin Storms <+19853776257> 5/1/2019, 3:03 PM
Walking in to visit my grandma with Alzheimer's

BH Ben Hakes <+19522203642> 5/1/2019, 3:03 PM
okay - I've got a 4 pm central, I could also talk at 5pm central

BH Ben Hakes <+19522203642> 5/1/2019, 3:04 PM
that's tough - my Grandma passed away with Alzheimers a couple of years ago

BH Ben Hakes <+19522203642> 5/1/2019, 3:04 PM
talk to you after

AS Austin Storms <+19853776257> 5/1/2019, 3:08 PM
Yessir I'll call you at 5

AS Austin Storms <+19853776257> 5/1/2019, 4:55 PM
Stuck in traffic, gimme 15

BH Ben Hakes <+19522203642> 5/1/2019, 4:56 PM
no problem - I'm free until 6:15

AS Austin Storms <+19853776257> 5/1/2019, 4:56 PM
Sweet

AS Austin Storms <+19853776257> 5/1/2019, 9:15 PM
I found the projects GP purchased - building the models now

AS Austin Storms <+19853776257> 5/2/2019, 6:54 AM

Exelon4-11 and HPW1

BH **Ben Hakes <+19522203642>** 5/2/2019, 8:21 AM
Noice

BH **Ben Hakes <+19522203642>** 5/2/2019, 9:00 AM
https://twitter.com/zerohedge/status/1123947753904775169?s=21

*File **"5979e00e-8278-4d3f-bc16-b1a1aad6e129.pluginPayloadAttachment"** is missing.*
Attachment: ~/Library/SMS/Attachments/70/00/E8D35CDB-1C73-4EEC-9195-A3D3FBACED96/4C174D1F-EE39-47C4-AEDF-0C118156D94D.pluginPayloadAttachment (22 KB)

BH **Ben Hakes <+19522203642>** 5/2/2019, 9:01 AM
^^Jeeze

BH **Ben Hakes <+19522203642>** 5/2/2019, 9:26 AM
Noice

BH **Ben Hakes <+19522203642>** 5/2/2019, 9:26 AM
^^Jeeze

AS **Austin Storms <+19853776257>** 5/2/2019, 9:32 AM
I'll be on the first plane out of the states when MMT gains significant political traction.

BH **Ben Hakes <+19522203642>** 5/2/2019, 9:35 AM
IMO a "flirt" with MMT-ism is inevitable.

BH **Ben Hakes <+19522203642>** 5/2/2019, 9:36 AM
Some might also call it "hyperbitcoinization"

AS **Austin Storms <+19853776257>** 5/2/2019, 10:06 AM
It'll happen. And I'll be sitting on a beach in South America with my laptop and my seed phrase tattooed to the bottom of my foot.

BH **Ben Hakes <+19522203642>** 5/2/2019, 10:07 AM
lol

BH **Ben Hakes <+19522203642>** 5/2/2019, 10:07 AM
seed phrase tattoo?

BH **Ben Hakes <+19522203642>** 5/2/2019, 10:07 AM
bad opec, no?

BH **Ben Hakes <+19522203642>** 5/2/2019, 10:08 AM
opsec

AS **Austin Storms <+19853776257>** 5/2/2019, 10:09 AM
Yea, you just memorized random ones and add a password via BIP39

AS **Austin Storms <+19853776257>** 5/2/2019, 10:09 AM
Like tattoo every other word, remember the 6 in between, and add your own password at the end.

AS **Austin Storms <+19853776257>** 5/2/2019, 10:10 AM
Otherwise, you get hit over the head and your bitcoin is lost in your memory forever.

3rd world countries are strange places for storage and seizures, best to one-use hardware wallets, recover, and destroy.

AS **Austin Storms <+19853776257>** 5/2/2019, 10:37 AM

Just emailed you over some of the EXELON data from the different sites - found the FERC approval request for the sale in Feb '19 to identify which assets they had purchased, the EXELON Wind 4 facility is 79.8MW

BH **Ben Hakes <+19522203642>** 5/2/2019, 10:41 AM

Cool - I'll take a look

AS **Austin Storms <+19853776257>** 5/2/2019, 11:22 AM

I think the model might break around midnight because of how the date time parses to build the csv url - I tried to fix it last night, but ran out of time.

Either way, it's now pulling the hourly DA LMP prices from the large csv (there are 24,000 entries because each of the 1,000 locations has 24 hours of DA LMP rates) and still utilizing RTBM LMP for the other.

AS **Austin Storms <+19853776257>** 5/3/2019, 8:50 AM

Just sat finished breakfast with Steve Barbour and his fiancé - very sharp dude.

BH **Ben Hakes <+19522203642>** 5/3/2019, 8:52 AM

That's awesome - you guys probably have a few things to talk about lol

BH **Ben Hakes <+19522203642>** 5/3/2019, 8:53 AM

I'd be interested to do some data crunching Sunday/Monday.

BH **Ben Hakes <+19522203642>** 5/3/2019, 8:54 AM

(Possibly tomorrow AM but not sure if you'll be traveling)

BH **Ben Hakes <+19522203642>** 5/3/2019, 8:55 AM

Thinking of building a lookup table for "node mining profitability"

AS **Austin Storms <+19853776257>** 5/3/2019, 9:03 AM

Can do tmrw morning, I fly out Sunday.

BH **Ben Hakes <+19522203642>** 5/3/2019, 9:04 AM

Cool - probably something around noon your time. Curious to hear how the conference was

AS **Austin Storms <+19853776257>** 5/3/2019, 1:48 PM

Man this summit is excellent, hope they make the recordings available for the public.

AS **Austin Storms <+19853776257>** 5/3/2019, 4:21 PM

Just linked up with Whatsminer Sales VP.

Can fly to China and bypass import fees for miners by shipping to Germany then to States.

BH **Ben Hakes <+19522203642>** 5/5/2019, 10:54 AM

A bitcoiner friend of mine sent me this. Good reads on MMT as describing the current state of central banking.

Two articles on MMT from a trader's point of view:
- https://www.themacrotourist.com/posts/2019/04/23/mmt1/
- https://www.themacrotourist.com/posts/2019/04/24/mmt2/

AS **Austin Storms <+19853776257>** 5/5/2019, 6:49 PM

Liked "A bitcoiner friend of mine sent me this. Good reads on MMT as describing the current state of central banking.

Two articles on MMT from a trader's point of view:
- https://www.themacrotourist.com/posts/2019/04/23/mmt1/
- https://www.themacrotourist.com/posts/2019/04/24/mmt2/"

AS **Austin Storms <+19853776257>** 5/6/2019, 11:02 AM
Interesting read.

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:03 AM
It's interesting to think about the consequent

AS **Austin Storms <+19853776257>** 5/6/2019, 11:03 AM
Long tail consequence are a bitch when playing with economic theory

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:03 AM
consequences of the fed just "cancelling" the debt it holds on the fed gov't

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:04 AM
I hadn't thought about it in the way the article describes it

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:05 AM
Ultimately I think MMT -underestimates the risks that you put yourself in a inflation/hyper inflation scenario

AS **Austin Storms <+19853776257>** 5/6/2019, 11:05 AM
The Japanese section is the most interesting to me - I've had very at length convos with Terrance Yang about this

AS **Austin Storms <+19853776257>** 5/6/2019, 11:07 AM
I think MMT doesn't barely *recognize* that risk. Internal Econ is so different than global, macro Econ.

Better have a lot of economic production in-house or your currency relative purchasing power gets slaughtered

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:07 AM
Also the trader ends up recommending holding fixed assets... but doesn't mention Bitcoin

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:08 AM
Sad! for him

AS **Austin Storms <+19853776257>** 5/6/2019, 11:08 AM
Have to hold global fixed assets to offset your currency's purchasing power getting slashed globally - why do you think gold has been in heavy accumulation for the past 10 years especially?

AS **Austin Storms <+19853776257>** 5/6/2019, 11:09 AM
On a separate note, I just converted over from SQLite3 local database to PostgreSQL and this shit is beautiful.

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:11 AM
Liked "Have to hold global fixed assets to offset your currency's purchasing power getting slashed globally - why do you think gold has been in heavy accumulation for the past 10 years especially?"

AS **Austin Storms <+19853776257>** 5/6/2019, 11:11 AM
^ for all of the mining data mapping.

There are people doing what we're trying to do in ERCOT iso in TX - met a few of the big energy/CFO types in Boston this past weekend + the big NG project the Winklevoss twins just backed.

AS **Austin Storms <+19853776257>** 5/6/2019, 11:12 AM
https://www.bloomberg.com/news/articles/2019-05-03/winklevosses-private-equity-eye-power-as-fix-for-u-s-gas-glut

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BH **Ben Hakes <+19522203642>** 5/6/2019, 11:12 AM
woah

AS **Austin Storms <+19853776257>** 5/6/2019, 11:13 AM
lancium.com

File ***"2a378e7a-2364-4ef4-8b67-86e6a6223a15.pluginPayloadAttachment"*** *is missing.*
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AS **Austin Storms <+19853776257>** 5/6/2019, 11:13 AM
https://www.linkedin.com/in/michael-mcnamara-1055211

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:14 AM
So Crusoe is competing with Steve Barbour

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:14 AM
Directly...

AS **Austin Storms <+19853776257>** 5/6/2019, 11:15 AM
^ Yes, but Steve's model is slightly different than their's.

AS **Austin Storms <+19853776257>** 5/6/2019, 11:15 AM
I'm designing a fan controller PDU for him now that should be done by Wednesday.

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:16 AM
sweeet

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:16 AM
sounds like it was a go-to conference

AS **Austin Storms <+19853776257>** 5/6/2019, 11:17 AM
It was. The guys at Lancium are doing what we are trying to do exactly, but they don't have a container builder or software team yet. Mike's pretty interested in my solution.

AS **Austin Storms <+19853776257>** 5/6/2019, 11:18 AM
Going to put the data together for all of the EXELON sites this afternoon and send to you and the GP team.

AS **Austin Storms <+19853776257>** 5/6/2019, 11:20 AM
I'm going to model the data from every pnode in the SPP and have it running in background as well.

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:23 AM
This is great - I think we start putting the heat on GP

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:24 AM
Things are obviously heating up

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:24 AM
both with BTC and LAAS/containerized solutions

AS **Austin Storms <+19853776257>** 5/6/2019, 11:25 AM
Yep - and Michael McNamara wants me to ping some of my former product managers for his distributed compute service.

They thing that ML services and neural network outsourcing is going to be a 15-20x play on current windpower pricing.

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:27 AM
woah

AS **Austin Storms <+19853776257>** 5/6/2019, 11:29 AM
He asked me if I was interested and I told him it'd have to be a helluva offer.

Plus they want my logic for curtailing miners on DA and RTMB LMP - all over dinner Friday night and several bottles of wine, they told me that they were looking into Digital Shovel, but their Schneider Electric/Siemens engineer was worried about 480/277v because of potential liability i.e. line to neutral voltage of 277 *kills* you if you touch it.

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:29 AM
I didn't think NN outsourcing was profitable yet

AS **Austin Storms <+19853776257>** 5/6/2019, 11:29 AM
It's not yet, long term infra play.

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:32 AM
Loved "He asked me if I was interested and I told him it'd have to be a helluva offer.

Plus they want my logic for curtailing miners on DA and RTMB LMP - all over dinner Friday night and several bottles of wine, they told me that they were looking into Digital Shovel, but their Schneider Electric/Siemens engineer was worried about 480/277v because of potential liability i.e. line to neutral voltage of 277 *kills* you if you touch it."

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:39 AM
Do you think you could do a raise before a deal was done with a generation asset owner? Or is the critical path to a raise a signed contract for X BearBoxes?

AS **Austin Storms <+19853776257>** 5/6/2019, 11:44 AM
It'd be difficult to raise either way without a field tested proof of concept - but with all of the data modeled, much easier by quantifying rev and risk.

AS **Austin Storms <+19853776257>** 5/6/2019, 11:45 AM
There are certain business reqs that I'm simply not privy to (unknown unknowns) from the generation asset compliance side - that's Glide Paths backyard and I imagine it changes for every jurisdiction in the SPP or ERCOT iso depending on regs, capital structures, etc.

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:46 AM
Liked "There are certain business reqs that I'm simply not privy to (unknown unknowns) from the generation asset compliance side - that's Glide Paths backyard and I imagine it changes for every jurisdiction in the SPP or ERCOT iso depending on regs, capital structures, etc."

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:46 AM
Liked "It'd be difficult to raise either way without a field tested proof of concept - but with all of the data modeled, much easier by quantifying rev and risk."

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:46 AM
Agreed - it's easier to sell with the data modeled

AS **Austin Storms <+19853776257>** 5/6/2019, 11:47 AM
I'll have the models up by the end of the day and figure out how to give remote access to provisioned users to the db for live views.

AS **Austin Storms <+19853776257>** 5/6/2019, 11:47 AM
This is why I switched to postgresql

BH **Ben Hakes <+19522203642>** 5/6/2019, 11:47 AM
Also agree that GP has institutional knowledge that is GP's specialty

BH Ben Hakes <+19522203642> 5/6/2019, 11:47 AM
Liked "This is why I switched to postgresql"

BH Ben Hakes <+19522203642> 5/6/2019, 11:48 AM
I guess I want to create some urgency for Dan/GP to give then a bit of FOMO

AS Austin Storms <+19853776257> 5/6/2019, 11:49 AM
Yea, I'll send out an email this afternoon detailing exactly what I've done, the conference, lancium team w Mike McNamara, and some of the NG projects happening now.

BH Ben Hakes <+19522203642> 5/6/2019, 11:49 AM
Great.

BH Ben Hakes <+19522203642> 5/6/2019, 11:49 AM
Send that and I think that email will eventually make it to Dan.

BH Ben Hakes <+19522203642> 5/6/2019, 11:51 AM
I'm very close to calling Dan to get his thoughts. Usually things happen faster when he gets going on ideas.

AS Austin Storms <+19853776257> 5/6/2019, 11:51 AM
The thing that's currently setting me apart from everyone else is the fully vertically integrated solution - there are plenty of hardware guys, but none are doing what I am from the software side because they don't know how.

That advantage won't last forever though.

BH Ben Hakes <+19522203642> 5/6/2019, 11:52 AM
Right.

BH Ben Hakes <+19522203642> 5/6/2019, 11:53 AM
At some point we just need to know where Dan/GP stand. I know these things are complicated and require lots of regulatory hurdles.

AS Austin Storms <+19853776257> 5/6/2019, 11:58 AM
Yep, exactly.

BH Ben Hakes <+19522203642> 5/6/2019, 12:52 PM
What was the conference called this weekend?

BH Ben Hakes <+19522203642> 5/6/2019, 12:52 PM
Mike Hoadley's GF works at Fidelity

BH Ben Hakes <+19522203642> 5/6/2019, 12:56 PM
I got it.

BH Ben Hakes <+19522203642> 5/6/2019, 12:57 PM
Just talked with MH, he said he probably would have gone to this conference. MH also said that they're getting some real estate issues cured and that closing should be 30-60 days.

AS Austin Storms <+19853776257> 5/6/2019, 4:58 PM
You have time for a 5 min chat?

BH Ben Hakes <+19522203642> 5/6/2019, 4:58 PM
yeah give me like 5 mins - i can call you if that's okay

AS Austin Storms <+19853776257> 5/6/2019, 4:58 PM
Yea np

AS Austin Storms <+19853776257> 5/10/2019, 12:42 PM
Haven't heard back from GP since last email. Nobody's selling S9s anymore - they're profitable at $0.10/kWh lol

BH Ben Hakes <+19522203642> 5/11/2019, 8:35 AM
Yeah. I think they are all busy and that this is more of a side project and not urgent for them... that's what happened with our first attempt.

BH Ben Hakes <+19522203642> 5/11/2019, 8:36 AM
(But again Dan loves this so when Dan says to fix it they start fixing it)

BH Ben Hakes <+19522203642> 5/11/2019, 8:37 AM
The other thing, any I don't know if this is coming into play here (it came into play last time)

BH Ben Hakes <+19522203642> 5/11/2019, 8:38 AM
Is that their capital, while significant, is discretionary.

BH Ben Hakes <+19522203642> 5/11/2019, 8:38 AM
Sorry is NOT discretionary.

BH Ben Hakes <+19522203642> 5/11/2019, 8:40 AM
Basically, they have to go to their capital partner for every deal, even if it's a no brainer. In PE you ALWAYS prefer discretionary as a manager cuz then you can move really fast.

BH Ben Hakes <+19522203642> 5/11/2019, 8:41 AM
My old CEO used to give people shit cuz their capital wasn't discretionary.

BH Ben Hakes <+19522203642> 5/11/2019, 8:42 AM
Tl;dr - they have to bring the mining deal to their capital partner as well instead of Dan just say "go".

BH Ben Hakes <+19522203642> 5/11/2019, 8:42 AM
Dan has significant influence but that just slows things down.

BH Ben Hakes <+19522203642> 5/11/2019, 8:44 AM
Also, thoughts on this rally? short squeezeeeee

AS Austin Storms <+19853776257> 5/11/2019, 2:51 PM
That all makes sense - just going to cost them more and more the longer they wait to make the decision (assuming price stays in the upward direction).

BH Ben Hakes <+19522203642> 5/11/2019, 2:51 PM
agreed

AS Austin Storms <+19853776257> 5/11/2019, 2:52 PM
A lot of BTC moving from Bitfinex cold wallet addresses - looks like people are dumping Tether for BTC.

Not sure if the rally is a big bull trap or what. I bought a significant amount of BTC at 3,300 after selling half my stack at 18k so I'm not complaining

AS Austin Storms <+19853776257> 5/11/2019, 2:54 PM
Breakeven price to mine BTC with a S9 is between $0.12-0.13/kWh right now lol - grid miners will come back online if they haven't capitulated already, hashrate might spike and drive profitability down and selling pressure up, price will stagnate potentially

BH **Ben Hakes <+19522203642>** 5/19/2019, 11:19 AM

Hey - Caught up w/ Mike Hoadley today on other stuff and I asked him about the panhandle project. He said to sit tight and that things will probably start to move a little more after their board meeting on May 30th. I asked him what course of action might be most likely right now and he said maybe buying that box of yours first, but running in parallel on a larger deal as well.

BH **Ben Hakes <+19522203642>** 5/19/2019, 11:22 AM

I get the impression though that cheap miners might be more difficult to come by now vs. a few months ago? I may want to temper expectations about their "entry costs", given that the price and attention have spiked in the last month.

AS **Austin Storms <+19853776257>** 5/19/2019, 12:16 PM

Liked "Hey - Caught up w/ Mike Hoadley today on other stuff and I asked him about the panhandle project. He said to sit tight and that things will probably start to move a little more after their board meeting on May 30th. I asked him what course of action might be most likely right now and he said maybe buying that box of yours first, but running in parallel on a larger deal as well."

AS **Austin Storms <+19853776257>** 5/19/2019, 12:16 PM

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AS **Austin Storms <+19853776257>** 5/19/2019, 12:18 PM

That box is sold - I'll have to build them another if they want one. Might be better given that previous gen miners are *very* hard to come by in any quantity.

AS **Austin Storms <+19853776257>** 5/19/2019, 12:19 PM

Still modeling the data at all of the EXELON sites as well, well send over to you when I get home tonight. Was in Baltimore for Preakness all weekend.

BH **Ben Hakes <+19522203642>** 5/19/2019, 12:22 PM

Liked "That box is sold - I'll have to build them another if they want one. Might be better given that previous gen miners are *very* hard to come by in any quantity."

BH **Ben Hakes <+19522203642>** 5/19/2019, 12:22 PM

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BH **Ben Hakes <+19522203642>** 5/19/2019, 12:22 PM

That's awesome - sounds like a blast.

AS **Austin Storms <+19853776257>** 5/19/2019, 12:22 PM

It was wild. Won $21k on a straight super

597:1 payout

BH **Ben Hakes <+19522203642>** 5/19/2019, 12:23 PM

Emphasized "It was wild. Won $21k on a straight super

597:1 payout"

BH **Ben Hakes <+19522203642>** 5/19/2019, 12:23 PM

BH **Ben Hakes <+19522203642>** 5/19/2019, 12:23 PM

BH **Ben Hakes <+19522203642>** 5/19/2019, 12:23 PM

Okay you definitely had fun then

AS **Austin Storms <+19853776257>** 5/19/2019, 12:25 PM

Yea it was absolutely nuts. A friend of mine had a private chalet in the infield and I'm officially spoiled for life.

How've you been? Lambda still rocking and rolling? Any interesting projects you're doing?

BH **Ben Hakes <+19522203642>** 5/19/2019, 10:23 PM

Laughed at "Yea it was absolutely nuts. A friend of mine had a private chalet in the infield and I'm officially spoiled for life.

How've you been? Lambda still rocking and rolling? Any interesting projects you're doing?"

BH **Ben Hakes <+19522203642>** 5/19/2019, 10:26 PM

Haha - sounds like a good friend to know.

Things are good. Still rocking on Lambda, got about 5-6 weeks left.

Working on a project doing some low level integrations with Bluetooth devices and push notifications RN. Also diving into more functional programming as well, which I'm really liking.

AS **Austin Storms <+19853776257>** 5/29/2019, 5:41 PM

Liked "Haha - sounds like a good friend to know.

Things are good. Still rocking on Lambda, got about 5-6 weeks left.

Working on a project doing some low level integrations with Bluetooth devices and push notifications RN. Also diving into more functional programming as well, which I'm really liking."

AS **Austin Storms <+19853776257>** 5/29/2019, 5:42 PM

Bluetooth devices and push notifications have a huge working field - there was so of that at Garmin while I was there and they were launching the vivofit and watch series.

AS **Austin Storms <+19853776257>** 5/29/2019, 5:44 PM

I just finished the script that takes every settlement location in the SPP, fetches DA & RT LMP from CSV for each, and calculates mining profitability statistics for them - each output to its own postgresql table.

AS **Austin Storms <+19853776257>** 5/29/2019, 5:45 PM

Image: ~/Library/SMS/Attachments/30/00/897CD39B-5E76-45B0-BC68-0ACAAD1E9229/58086274507__8D52E9A5-F828-4E65-AF56-FCFE1672B689.JPG (7 MB)

BH **Ben Hakes <+19522203642>** 5/29/2019, 8:46 PM

BH **Ben Hakes <+19522203642>** 5/29/2019, 8:46 PM

That's so cool.

BH Ben Hakes <+19522203642> 5/29/2019, 8:47 PM

BH Ben Hakes <+19522203642> 5/29/2019, 8:48 PM
Would someone buy this?

AS Austin Storms <+19853776257> 5/29/2019, 8:50 PM
Not sure - I might turn it into a live site that tracks Bitcoin mining profitability of different mining machines across all sites.

AS Austin Storms <+19853776257> 6/1/2019, 7:56 PM
The guy who was going to buy my prototype container had his power delayed for 3 months and doesn't want it anymore - not sure if GlidePath is interested in it and machines still.

BH Ben Hakes <+19522203642> 6/1/2019, 9:48 PM
Liked "The guy who was going to buy my prototype container had his power delayed for 3 months and doesn't want it anymore - not sure if GlidePath is interested in it and machines still."

BH Ben Hakes <+19522203642> 6/1/2019, 9:49 PM
I'll call Dan next week

AS Austin Storms <+19853776257> 6/10/2019, 4:47 PM
https://www.youtube.com/watch?v=YwYjfJAp-lo

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AS Austin Storms <+19853776257> 6/10/2019, 4:47 PM
https://www.youtube.com/watch?v=1JhvxMo8khk

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BH Ben Hakes <+19522203642> 6/13/2019, 1:51 PM
Some people get excited about new episodes of their latest Netflix show. I get excited about watching panel talks from bitcoin mining conferences

BH Ben Hakes <+19522203642> 6/13/2019, 2:52 PM
Even this intro is incredibly professional

AS Austin Storms <+19853776257> 6/13/2019, 4:30 PM
The entire summit was very well done.

BH Ben Hakes <+19522203642> 6/18/2019, 11:52 AM
Sounds like GP is finally going to close on the site in early July

AS Austin Storms <+19853776257> 6/18/2019, 11:58 AM

Which site?

BH Ben Hakes <+19522203642> 6/18/2019, 11:58 AM
"Stockyards" I guess... I think it's still the Texas one

BH Ben Hakes <+19522203642> 6/18/2019, 11:59 AM
They had to secure the land as well.

AS Austin Storms <+19853776257> 6/18/2019, 11:59 AM
Ah I see.

BH Ben Hakes <+19522203642> 6/20/2019, 3:34 PM
You still trying to offload that box?

BH Ben Hakes <+19522203642> 6/20/2019, 3:35 PM
What are the high-level specs again? Mikes wondering about ballpark costs w/ delivery.

AS Austin Storms <+19853776257> 6/20/2019, 4:02 PM
Definitely could - just buttoned it up last week. I'll put together pricing as-is (basic Raptor CryptoBeast, manual fan control) with delivery and then upgraded pricing with my custom PDUs, fan relay controller, etc. this afternoon when I get home.

High-level specs are 120/208Y, LLLG (no neutral), fed overhead with mast kit or underneath from pad mount, 1200A main, designed for ~275kW at full load of 192 machines.

Reasonably, I'd estimate 3/4 of the hashing boards are operational, so there's likely ~2PH/s @ 200kW most likely.

AS Austin Storms <+19853776257> 6/20/2019, 4:06 PM
I'm about done putting together the pitch deck on how the boxes and PDUs are designed from a hardware perspective and how the software works down to the script/database level.

Will be interesting to see who's about it next week in SF.

BH Ben Hakes <+19522203642> 6/20/2019, 4:12 PM
Liked "Definitely could - just buttoned it up last week. I'll put together pricing as-is (basic Raptor CryptoBeast, manual fan control) with delivery and then upgraded pricing with my custom PDUs, fan relay controller, etc. this afternoon when I get home.

High-level specs are 120/208Y, LLLG (no neutral), fed overhead with mast kit or underneath from pad mount, 1200A main, designed for ~275kW at full load of 192 machines.

Reasonably, I'd estimate 3/4 of the hashing boards are operational, so there's likely ~2PH/s @ 200kW most likely."

BH Ben Hakes <+19522203642> 6/20/2019, 4:12 PM
Sweet

AS Austin Storms <+19853776257> 6/20/2019, 4:14 PM
Also, sent you an email with some screenshots of the db - I've been logging data across all 1,000+ settlement locations in the SPP in 5 minute increments for a week or so.

The data is ridiculous.

BH Ben Hakes <+19522203642> 6/20/2019, 4:42 PM
That is so cool. Any patterns that you've started to see?

AS Austin Storms <+19853776257> 6/21/2019, 12:11 AM
Haven't done much analysis besides hashrate distribution - looks like +13 hours brings on a lot

AS Austin Storms <+19853776257> 6/21/2019, 1:18 PM
Unknown to me, my partner agreed to sell the Dragonmints last week to a hosting company - they texted me this

morning and are picking them up Sunday afternoon.

Feel free to tell Mike that I've got the container but no machines and I apologize for not knowing sooner.

BH **Ben Hakes <+19522203642>** 6/26/2019, 8:50 AM

Hey sorry I've been late to respond to this - hope the meetings in SF are going well.

Conference looks pretty good (still might have enjoyed the mining conf videos more).

AS **Austin Storms <+19853776257>** 6/28/2019, 5:32 PM

All good bro - just got back from SF. Wild week out there.

AS **Austin Storms <+19853776257>** 6/28/2019, 5:32 PM

Mining conference was better - this was more networking.

AS **Austin Storms <+19853776257>** 6/28/2019, 5:33 PM

About to send you CSV dumps of the past two week data comps for GP sites.

Never heard back from Mike after the last emails.

AS **Austin Storms <+19853776257>** 7/31/2019, 10:43 AM

Yo! You finish Lambda yet??

BH **Ben Hakes <+19522203642>** 7/31/2019, 11:17 AM

Yo! They asked me to TA so I've been doing that for a little bit. Still got like 4 weeks left of the curriculum but is all CS stuff. Got some interviews coming up.

You been busy?

BH **Ben Hakes <+19522203642>** 7/31/2019, 11:18 AM

Btw I guess GP is still kicking around mining... their just kinda slow about it.

BH **Ben Hakes <+19522203642>** 7/31/2019, 11:19 AM

They're

BH **Ben Hakes <+19522203642>** 7/31/2019, 11:20 AM

We should catch up. Also, did you end up moving?

AS **Austin Storms <+19853776257>** 7/31/2019, 11:24 AM

Liked "Yo! They asked me to TA so I've been doing that for a little bit. Still got like 4 weeks left of the curriculum but is all CS stuff. Got some interviews coming up.

You been busy?"

AS **Austin Storms <+19853776257>** 7/31/2019, 11:25 AM

Solid solid. What do you do as a TA? I've been mega busy, but just flew to Vail to take a week and reset.

AS **Austin Storms <+19853776257>** 7/31/2019, 11:25 AM

Haven't moved yet hahaha

BH **Ben Hakes <+19522203642>** 7/31/2019, 11:26 AM

Liked "Solid solid. What do you do as a TA? I've been mega busy, but just flew to Vail to take a week and reset. "

BH **Ben Hakes <+19522203642>** 7/31/2019, 11:26 AM

That's awesome. Get some sleep and go be in nature.

BH **Ben Hakes <+19522203642>** 7/31/2019, 11:27 AM

TA do technical code reviews and a spot of technical project management. Nothing too crazy.

BH Ben Hakes <+19522203642> 7/31/2019, 11:28 AM
The run to ~13k woke some people up

AS Austin Storms <+19853776257> 7/31/2019, 11:29 AM
Liked "TA do technical code reviews and a spot of technical project management. Nothing too crazy."

AS Austin Storms <+19853776257> 7/31/2019, 11:29 AM
Liked "The run to ~13k woke some people up"

BH Ben Hakes <+19522203642> 7/31/2019, 11:29 AM
I thought of you cuz the other week when the senate and house were having hearings on crypto, there was another senate/house hearing on "securing and transforming our electric grid"

AS Austin Storms <+19853776257> 7/31/2019, 11:30 AM
Yes it did - everyone who was dragging ass to build out ops is panicking right now.

A lot of ASICs on the ground still.

BH Ben Hakes <+19522203642> 7/31/2019, 11:30 AM
I thought, joke on everyone cuz those topics are the same

AS Austin Storms <+19853776257> 7/31/2019, 11:30 AM
Liked "I thought of you cuz the other week when the senate and house were having hearings on crypto, there was another senate/house hearing on "securing and transforming our electric grid""

AS Austin Storms <+19853776257> 7/31/2019, 11:30 AM
Liked "I thought, joke on everyone cuz those topics are the same"

AS Austin Storms <+19853776257> 7/31/2019, 11:30 AM
The sooner that electricity prices are denominated in BTC, the sooner we have hyperbitcoinization.

BH Ben Hakes <+19522203642> 7/31/2019, 11:31 AM
The narrative is slowly creeping into the mainstream

BH Ben Hakes <+19522203642> 7/31/2019, 11:32 AM
I've got liberal friends and conservative friends and it's funny because there's an argument for each of them

BH Ben Hakes <+19522203642> 7/31/2019, 11:34 AM
I like to poke my liberal friends recently by asking them if they support sanctions on foreign govt like Iran, made possible by USD hedgemony

BH Ben Hakes <+19522203642> 7/31/2019, 11:34 AM
Or the fact that fiat allows govt to print money for war that they don't have

AS Austin Storms <+19853776257> 7/31/2019, 11:43 AM
Emphasized "I like to poke my liberal friends recently by asking them if they support sanctions on foreign govt like Iran, made possible by USD hedgemony"

AS Austin Storms <+19853776257> 7/31/2019, 11:43 AM
Emphasized "Or the fact that fiat allows govt to print money for war that they don't have"

AS Austin Storms <+19853776257> 7/31/2019, 11:56 AM
Same. They don't have an answer for the Iranian OFAC sanctions.

AS **Austin Storms <+19853776257>** 7/31/2019, 11:57 AM
The 18 year "war" we've been in has been summarily funded by the 2001 AUMF, passed three days after 9/11.

Never ending funding to hunt terrorists all over the globe without Congress having to declare war is ridiculous.

BH **Ben Hakes <+19522203642>** 7/31/2019, 5:42 PM
Disliked "The 18 year "war" we've been in has been summarily funded by the 2001 AUMF, passed three days after 9/11.

Never ending funding to hunt terrorists all over the globe without Congress having to declare war is ridiculous."

BH **Ben Hakes <+19522203642>** 7/31/2019, 5:42 PM
absolutely nuts

BH **Ben Hakes <+19522203642>** 7/31/2019, 5:43 PM
happy fed funds rate cut day BTW

AS **Austin Storms <+19853776257>** 7/31/2019, 5:46 PM
LMFAO same to you

AS **Austin Storms <+19853776257>** 7/31/2019, 5:46 PM
#BuyBitcoin

BH **Ben Hakes <+19522203642>** 7/31/2019, 6:00 PM
#minebitcoin

AS **Austin Storms <+19853776257>** 7/31/2019, 9:42 PM
Liked "#minebitcoin"

AS **Austin Storms <+19853776257>** 8/21/2019, 8:44 AM
Looks like GP is still interested in mining

AS **Austin Storms <+19853776257>** 8/21/2019, 8:50 AM
What are you up to? TA at Lambda or did big tech scoop you up?

BH **Ben Hakes <+19522203642>** 8/21/2019, 9:59 AM
Yeah - not surprised but they're just slow as molasses

BH **Ben Hakes <+19522203642>** 8/21/2019, 10:01 AM
Got a few weeks left of TA-ing but got an offer from Coinbase yesterday for an internship-to-hire program.

AS **Austin Storms <+19853776257>** 8/21/2019, 10:21 AM
Liked "Got a few weeks left of TA-ing but got an offer from Coinbase yesterday for an internship-to-hire program."

AS **Austin Storms <+19853776257>** 8/21/2019, 10:21 AM

Image: ~/Library/SMS/Attachments/1f/15/30AB2DFB-9E58-4443-BBC7-6A48B6E85C47/IMG_3063.gif (2 MB)

AS **Austin Storms <+19853776257>** 8/21/2019, 10:21 AM
Love that - just don't work on any of their shitcoin casino stuff lmfao

BH **Ben Hakes <+19522203642>** 8/21/2019, 10:23 AM
Laughed at an image

BH **Ben Hakes <+19522203642>** 8/21/2019, 10:24 AM
Ha! Yea we'll see. It's an interesting opportunity but open to other ideas still. My lady got a full-time offer here in Minnesota so gotta take that into consideration as well.

AS **Austin Storms <+19853776257>** 8/21/2019, 10:24 AM
That's very important to consider. What about remote ops?

BH **Ben Hakes <+19522203642>** 8/21/2019, 10:25 AM
do you mean something specific with remote ops?

AS **Austin Storms <+19853776257>** 8/21/2019, 10:26 AM
Like would you consider remote work if the right opportunity came along?

BH **Ben Hakes <+19522203642>** 8/21/2019, 10:26 AM
Definitely.

AS **Austin Storms <+19853776257>** 8/21/2019, 10:27 AM
A friend of mine is the recruiter for Entergy's new CUBE team and they're trying to poach me for one of their PM positions - told them they need to hire devs remotely if they want good talent (nobody wants to move to New Orleans) and that Lambda is who I'd source from.

BH **Ben Hakes <+19522203642>** 8/21/2019, 10:27 AM
Good idea.

BH **Ben Hakes <+19522203642>** 8/21/2019, 10:28 AM
I don't think people area going to be able to attract talent without remote ops in the future.

AS **Austin Storms <+19853776257>** 8/21/2019, 10:30 AM
The CUBE team is their "startup culture/thinktank" within the org and has 100% buy-in from C-level. They're doing a full AMI (advanced metering) rollout over the next 2 years and will need big data folks and iOS engineers (the app is total horseshit, take a look at it if you get a chance) to push the strategic org goals to customers.

BH **Ben Hakes <+19522203642>** 8/21/2019, 10:31 AM
sounds cool

BH Ben Hakes <+19522203642> 8/21/2019, 10:31 AM
how are things going for you? BTW did you ever decide to move somewhere?

AS Austin Storms <+19853776257> 8/21/2019, 10:35 AM
Things are good - had some family stuff come up, met a girl, and I'm staying in NOLA for the foreseeable future.

AS Austin Storms <+19853776257> 8/21/2019, 10:42 AM
What about you? Life's good?

BH Ben Hakes <+19522203642> 8/21/2019, 12:14 PM
Liked "Things are good - had some family stuff come up, met a girl, and I'm staying in NOLA for the foreseeable future."

BH Ben Hakes <+19522203642> 8/21/2019, 12:15 PM
a lady in the picture, eh? I hope she's not a no coiner.... 😱

BH Ben Hakes <+19522203642> 8/21/2019, 12:16 PM
My lady and I actually got engaged last week! 💎

AS Austin Storms <+19853776257> 8/21/2019, 12:16 PM
I gave her my annotated copy of Economics in One Lesson yesterday, slowly red-pilling her into full-blown libertarianism and Bitcoin.

AS Austin Storms <+19853776257> 8/21/2019, 12:16 PM
Loved "My lady and I actually got engaged last week! 💎"

AS Austin Storms <+19853776257> 8/21/2019, 12:16 PM
Dude congrats!!!!!

BH Ben Hakes <+19522203642> 8/21/2019, 12:16 PM
Laughed at "I gave her my annotated copy of Economics in One Lesson yesterday, slowly red-pilling her into full-blown libertarianism and Bitcoin."

AS Austin Storms <+19853776257> 8/21/2019, 12:16 PM
That's huge

BH Ben Hakes <+19522203642> 8/21/2019, 12:16 PM
Thank you!

BH Ben Hakes <+19522203642> 8/21/2019, 12:17 PM
Loved "Dude congrats!!!!!"

BH Ben Hakes <+19522203642> 8/21/2019, 12:17 PM
yeah - I'm a lucky guy.

AS Austin Storms <+19853776257> 8/21/2019, 12:17 PM
What does she do? You said she just got an offer in MN?

BH Ben Hakes <+19522203642> 8/21/2019, 12:17 PM
Proposed at her g-mas farm in rural New England. It was solid.

BH Ben Hakes <+19522203642> 8/21/2019, 12:19 PM
Yeah she's in biz school but was to do HR-stuff. I gave her some bitcoin for brunch money when we first started dating... fun to look back on that

BH Ben Hakes <+19522203642> 8/21/2019, 12:19 PM
wants*

AS **Austin Storms <+19853776257>** 8/21/2019, 12:19 PM
That sounds solid - HR is the heartbeat of any org.

AS **Austin Storms <+19853776257>** 8/21/2019, 12:20 PM
And bitcoin for brunch money, huh? Sounds like a movie title lol

BH **Ben Hakes <+19522203642>** 8/21/2019, 12:21 PM
the $50 worth of eggs and coffee is now worth like $500

AS **Austin Storms <+19853776257>** 8/21/2019, 12:22 PM
Now it's 10 more brunch moneys!

AS **Austin Storms <+19853776257>** 8/21/2019, 12:22 PM
Absolute scarcity is a wild thing, huh?

BH **Ben Hakes <+19522203642>** 8/21/2019, 12:24 PM
something beautiful about the compounding reflected in both the value and our relationship over time

AS **Austin Storms <+19853776257>** 8/21/2019, 12:27 PM
Facts. Relationships are the only thing that appreciate better than Bitcoin.

BH **Ben Hakes <+19522203642>** 8/21/2019, 12:33 PM
Loved "Facts. Relationships are the only thing that appreciate better than Bitcoin."

BH **Ben Hakes <+19522203642>** 8/21/2019, 12:33 PM
100%

AS **Austin Storms <+19853776257>** 8/21/2019, 12:35 PM
And I think that's a function of time's perceived scarcity - another philosophical topic that I imagine we're aligned on haha

BH **Ben Hakes <+19522203642>** 8/21/2019, 12:39 PM
for sure

AS **Austin Storms <+19853776257>** 9/6/2019, 1:00 PM
Did you take the Coinbase position? Saw Austen tweeted that they'd filled a spot there with one of y'all Lambda grads.

AS **Austin Storms <+19853776257>** 9/6/2019, 1:00 PM
👀

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BH **Ben Hakes <+19522203642>** 9/8/2019, 10:47 PM
Yo! Was down in Madison at a college reunion this weekend so just catching back up.

BH **Ben Hakes <+19522203642>** 9/8/2019, 10:51 PM
I actually did not take the coinbase offer.

It was very tempting, but I got offered a dev position about 2 miles from my apartment that I am pretty excited about. Actually have my first day tomorrow.

BH **Ben Hakes <+19522203642>** 9/8/2019, 10:53 PM
I'm going to continue to hustle on side projects though.

BH **Ben Hakes <+19522203642>** 9/8/2019, 10:54 PM
How's everything going with you?

AS **Austin Storms <+19853776257>** 9/10/2019, 11:40 AM
Liked "I actually did not take the coinbase offer.

It was very tempting, but I got offered a dev position about 2 miles from my apartment that I am pretty excited about. Actually have my first day tomorrow."

AS **Austin Storms <+19853776257>** 9/10/2019, 11:42 AM
That's fantastic dude. And everything's good. Got an offer to go up to Lexington and come on board to a friend's startup that I'm probably gonna take and still hustle on some BTC side projects.

BH **Ben Hakes <+19522203642>** 9/11/2019, 8:07 AM
That's sweet man. What does that start up do?

Let me know if you get any ideas for mobile apps, especially for BB that you'd want to prototype. I could potentially prototype or design some stuff.

AS **Austin Storms <+19853776257>** 9/11/2019, 8:08 AM
Liked "That's sweet man. What does that start up do?

Let me know if you get any ideas for mobile apps, especially for BB that you'd want to prototype. I could potentially prototype or design some stuff."

AS **Austin Storms <+19853776257>** 9/11/2019, 8:10 AM
Modular mobile apps. Something like "platform as a service."

BH **Ben Hakes <+19522203642>** 9/11/2019, 8:14 AM
Liked "Modular mobile apps. Something like "platform as a service." "

AS **Austin Storms <+19853776257>** 9/11/2019, 8:15 AM
Their big prod is a mobile first salesforce, but that's going to take another 6 mos to finish. He wanted me as their enterprise blockchain guy, I told him only Bitcoin stuff. Probably going to do a Microsoft ION integration as well (he's also the state director in KY for their IAMS).

BH **Ben Hakes <+19522203642>** 9/11/2019, 8:43 AM
Cool. What is IAMS?

AS **Austin Storms <+19853776257>** 9/11/2019, 8:51 AM
Identity access mgmt

BH **Ben Hakes <+19522203642>** 9/11/2019, 9:27 AM
Liked "Identity access mgmt"

AS **Austin Storms <+19853776257>** 9/11/2019, 1:55 PM
Network hashrate went over estimated 102 EH/s briefly this morning 👀

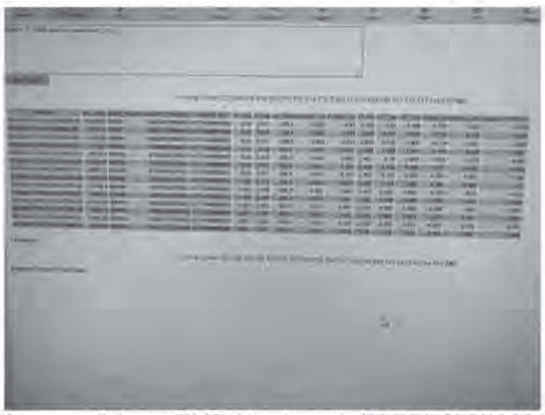
BH **Ben Hakes <+19522203642>** 9/11/2019, 4:18 PM
Dang... what's your profitability model looking like right now? I'd be interested in $/kwh

BH **Ben Hakes <+19522203642>** 9/11/2019, 4:18 PM
Seems like peeps are getting their last run in before the halvening?

AS **Austin Storms <+19853776257>** 9/11/2019, 4:22 PM
Looks like S9 rev is still breakeven at ~$.072/kWh

AS **Austin Storms <+19853776257>** 9/11/2019, 4:23 PM
When that gets to $.035-.04/kWh, those machines start turning off and difficulty should drop a good bit. I don't expect that until 130EH/s, probably late Oct/early Nov if we stay in this $10k range

AS **Austin Storms <+19853776257>** 9/11/2019, 4:28 PM



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BH **Ben Hakes <+19522203642>** 9/11/2019, 4:29 PM
Liked "When that gets to $.035-.04/kWh, those machines start turning off and difficulty should drop a good bit. I don't expect that until 130EH/s, probably late Oct/early Nov if we stay in this $10k range"

BH **Ben Hakes <+19522203642>** 10/15/2019, 12:18 PM
https://fortune.com/2019/10/15/what-is-bitcoin-mining-layer1-peter-thiel-crypto-investment/amp/?__twitter_impression=true

AS **Austin Storms <+19853776257>** 10/15/2019, 12:20 PM
Yep - talked with Alex a few weeks ago. They've got a good team but he's not experienced and they made some false claims in their deck...

AS **Austin Storms <+19853776257>** 10/15/2019, 12:21 PM
Terrance Yang was in their seed round at Layer1 Capital and sent me the deck/setup the call for some due diligence questions. Their team is entirely offshore and R&D is in Moscow/Shenzhen. Can send you the deck if you want

AS **Austin Storms <+19853776257>** 10/15/2019, 12:46 PM

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BH **Ben Hakes <+19522203642>** 10/15/2019, 2:20 PM
[illegible]

AS **Austin Storms <+19853776257>** 10/15/2019, 2:21 PM
And I just got access to the Crusoe Energy/Upper90 deck for their series A.

BH **Ben Hakes <+19522203642>** 10/15/2019, 2:37 PM
Are they mining as well?

AS **Austin Storms <+19853776257>** 10/15/2019, 2:38 PM
Yea that's the Bain Capital/Winklevoss backed startup operating off of flared natural gas in WY, CO, and the Dakotas.

BH **Ben Hakes <+19522203642>** 10/15/2019, 2:51 PM
Big boys are legging in

AS **Austin Storms <+19853776257>** 10/15/2019, 2:52 PM
Yep - just emailed GP team.

AS **Austin Storms <+19853776257>** 4/29/2020, 10:08 AM
Yo

BH **Ben Hakes <+19522203642>** 4/29/2020, 10:35 AM
Yo whats happenin

AS **Austin Storms <+19853776257>** 4/29/2020, 10:38 AM
Just checking in to see what you've been up to! Still doing iOS engineering?

BH **Ben Hakes <+19522203642>** 4/29/2020, 10:44 AM
Yeah man - we've got a greenfield app that's about to get released at work - great learning experience. Have taken break from side projects while I learn some new mobile architectures but am going to start buildings some new apps soon.

BH **Ben Hakes <+19522203642>** 4/29/2020, 10:45 AM
How bout you?

BH **Ben Hakes <+19522203642>** 4/29/2020, 10:45 AM
Side note - super pumped for the halvening

AS **Austin Storms <+19853776257>** 4/29/2020, 10:51 AM
Liked "Yeah man - we've got a greenfield app that's about to get released at work - great learning experience. Have taken break from side projects while I learn some new mobile architectures but am going to start buildings some new apps soon."

AS **Austin Storms <+19853776257>** 4/29/2020, 10:55 AM
Fantastic - greenfield like from scratch? I'm not as familiar with mobile dev.

AS **Austin Storms <+19853776257>** 4/29/2020, 10:57 AM
Staying busy on the mining side - got brought on early to the GAM team last year and we're solving the flared natural gas problem for O&G producers and expanding into other renewable verticals that make sense.

I'm about to reach out to the GlidePath team again to check their pulse.

AS **Austin Storms <+19853776257>** 4/29/2020, 10:58 AM
I'm also super excited for the halvening - there are a LOT of S9's still operating that need to come off. Average TH/s on Slushpool is 33TH/s - that needs to get to the 50TH/s range before we can really take off.

BH **Ben Hakes <+19522203642>** 4/29/2020, 11:04 AM
Liked "Staying busy on the mining side - got brought on early to the GAM team last year and we're solving the flared

natural gas problem for O&G producers and expanding into other renewable verticals that make sense.

I'm about to reach out to the GlidePath team again to check their pulse."

BH **Ben Hakes <+19522203642>** 4/29/2020, 11:05 AM
Yeah - the new app is being built from scratch.

BH **Ben Hakes <+19522203642>** 4/29/2020, 11:05 AM
Does GAM stand for something?

AS **Austin Storms <+19853776257>** 4/29/2020, 11:06 AM
Liked "Yeah - the new app is being built from scratch."

AS **Austin Storms <+19853776257>** 4/29/2020, 11:06 AM
Great American Mining

BH **Ben Hakes <+19522203642>** 4/29/2020, 11:07 AM
Ahh yeah.

You should reach out to GP, however I did get a message from Mike H. a couple months ago and said that he was no longer with GlidePath (I think he was getting bored). That's not necessarily a bad thing tho as Dan was really the shot caller there.

BH **Ben Hakes <+19522203642>** 4/29/2020, 11:08 AM
People still running S9's!?! Jeeze

BH **Ben Hakes <+19522203642>** 4/29/2020, 11:09 AM
Lol

AS **Austin Storms <+19853776257>** 4/29/2020, 11:10 AM
Emphasized "Ahh yeah.

You should reach out to GP, however I did get a message from Mike H. a couple months ago and said that he was no longer with GlidePath (I think he was getting bored). That's not necessarily a bad thing tho as Dan was really the shot caller there."

AS **Austin Storms <+19853776257>** 4/29/2020, 11:10 AM
Bored?!? Lol

AS **Austin Storms <+19853776257>** 4/29/2020, 11:10 AM
And yes, people are still running S9's - either really cheap power or just laundering via mining

BH **Ben Hakes <+19522203642>** 4/29/2020, 11:11 AM
Haha yeah I'm not sure... looking back, he might of wished he'd kept the steady paycheck

AS **Austin Storms <+19853776257>** 4/29/2020, 11:12 AM
I think there's a lot of folks in hindsight who wish they'd have done that!

BH **Ben Hakes <+19522203642>** 4/29/2020, 11:13 AM
Haha for sure! Also, Just seeing this 8Hut coindesk piece

AS **Austin Storms <+19853776257>** 4/29/2020, 11:14 AM
Yea I read it this morning - Hut8 is in trouble

AS **Austin Storms <+19853776257>** 4/29/2020, 11:14 AM
Too much capex spend

AS **Austin Storms <+19853776257>** 4/29/2020, 11:14 AM

Too much burn

BH Ben Hakes <+19522203642> 4/29/2020, 11:14 AM
They were always too suit and tie for me

BH Ben Hakes <+19522203642> 4/29/2020, 11:15 AM
Had my doubts they could pull it off

AS Austin Storms <+19853776257> 4/29/2020, 11:18 AM
Liked "They were always too suit and tie for me"

AS Austin Storms <+19853776257> 4/29/2020, 11:18 AM
100%

AS Austin Storms <+19853776257> 4/29/2020, 11:18 AM
Trying to teach the GAM guys that burning capital for anything non-essential is bad bad in this industry.

BH Ben Hakes <+19522203642> 4/29/2020, 11:55 AM
Liked "Trying to teach the GAM guys that burning capital for anything non-essential is bad bad in this industry."

BH Ben Hakes <+19522203642> 4/29/2020, 11:55 AM
Bitcoin is a teacher

BH Ben Hakes <+19522203642> 4/29/2020, 11:56 AM
Hard for guys that have been around funny money spaces like investment banking / PE all their life

AS Austin Storms <+19853776257> 4/29/2020, 11:56 AM
No doubt. It's ruthless capitalism

AS Austin Storms <+19853776257> 4/29/2020, 11:57 AM
The Crusoe Energy guys are in big big trouble - too much burn with a 25+ man team and their model is contingent on O&G producers paying them.

A lot of ppl are about to get taught

BH Ben Hakes <+19522203642> 4/29/2020, 11:58 AM
Yup. They can't rely on their Cantillon supremacy anymore.

AS Austin Storms <+19853776257> 4/29/2020, 11:58 AM
Facts.

BH Ben Hakes <+19522203642> 4/29/2020, 11:58 AM
Rekt

AS Austin Storms <+19853776257> 4/29/2020, 12:01 PM
Bigly rekt.

AS Austin Storms <+19853776257> 4/29/2020, 12:01 PM
That's why I was so crazy about the GP team and them not deploying old gen miners even though they were cheap and power was essentially free.

AS Austin Storms <+19853776257> 4/29/2020, 12:01 PM
Hard paradigm shift to make though.

AS Austin Storms <+19853776257> 5/22/2020, 10:39 AM
https://www.prnewswire.com/news-releases/layer1-launches-bitcoin-batteries-to-stabilize-energy-grids-by-releasing-electricity-to-meet-market-demand-301063984.html

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AS **Austin Storms <+19853776257>** 5/22/2020, 10:39 AM
This is load as a service.

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:54 PM
"Layer1's proprietary demand-response software"

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:54 PM
... like a few lines of python 😎😑

AS **Austin Storms <+19853776257>** 5/23/2020, 4:55 PM
Literally less than 100 to kill all of the power

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:55 PM
Lol

AS **Austin Storms <+19853776257>** 5/23/2020, 4:55 PM
Denis and the GP team got back to me and said they reviewed the models and it wasn't enticing enough for them.

AS **Austin Storms <+19853776257>** 5/23/2020, 4:55 PM
Looking for a 2 year payback.

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:56 PM
Huh...

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:56 PM
"The increased installation of renewable energy production capacity will require increased demand response services from companies like Layer1,"

AS **Austin Storms <+19853776257>** 5/23/2020, 4:57 PM

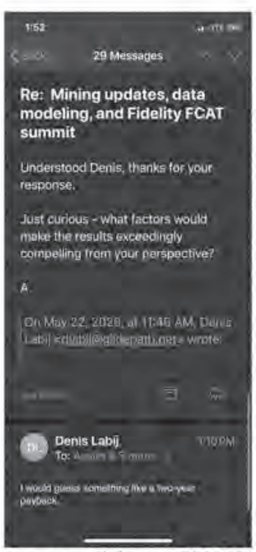

Image: ~/Library/SMS/Attachments/02/02/5B64529B-9407-40B3-A11C-829987AB981D/IMG_5250.PNG (818 KB)

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:57 PM
Can't say we were off

AS **Austin Storms <+19853776257>** 5/23/2020, 4:57 PM
You were dead on.

AS **Austin Storms <+19853776257>** 5/23/2020, 4:57 PM
I just build the stuff.

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:57 PM
Liked an image

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:58 PM
Would be interesting to hear denis's response

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:58 PM
I think they just don't have the pocketbook or the risk capital to be that entrepreneurial

AS **Austin Storms <+19853776257>** 5/23/2020, 4:58 PM

Image: ~/Library/SMS/Attachments/01/01/009054FC-D566-48A8-9B6F-5D48785911B7/IMG_5258.PNG (4 MB)

AS **Austin Storms <+19853776257>** 5/23/2020, 4:58 PM
Designed and built these PDUs for GAM recently.

AS **Austin Storms <+19853776257>** 5/23/2020, 4:58 PM

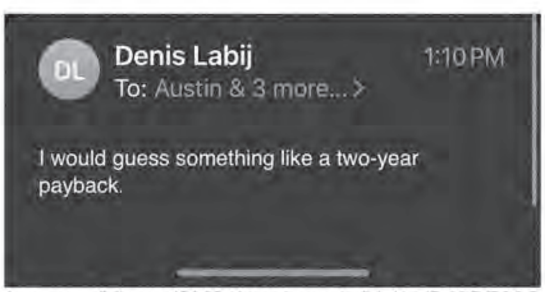

Image: ~/Library/SMS/Attachments/bb/11/D49DE29C-6809-4CA0-8861-24090D4FADB1/RenderedImage.jpg (66 KB)

AS **Austin Storms <+19853776257>** 5/23/2020, 4:58 PM
Yea it's too much risk I think.

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:58 PM
Ooh

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:58 PM
I see

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:59 PM
Ya they're working with institutional money too

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:59 PM
If it was all their own they might do it

BH **Ben Hakes <+19522203642>** 5/23/2020, 4:59 PM
Reputation risk of crypto is real, though it's diminishing in finance right now

BH **Ben Hakes <+19522203642>** 5/23/2020, 5:00 PM
Of course in the long run I think we're right but sort term we might look stupid for a bit

BH **Ben Hakes <+19522203642>** 5/23/2020, 5:00 PM
Emphasized an image

BH **Ben Hakes <+19522203642>** 5/23/2020, 5:00 PM
Those PDUs are dope man!

AS **Austin Storms <+19853776257>** 5/23/2020, 5:12 PM
Loved "Of course in the long run I think we're right but sort term we might look stupid for a bit"

AS **Austin Storms <+19853776257>** 5/23/2020, 5:13 PM
That's usually how all great ideas are in the beginning

AS **Austin Storms <+19853776257>** 5/23/2020, 5:13 PM
Thanks! They're 480Y/277VAC rated 👀

BH **Ben Hakes <+19522203642>** 5/23/2020, 5:14 PM
There was one quote from Thiel, or Paul Graham saying that one market of most successful people is their willingness to look stupid in the short term...

BH **Ben Hakes <+19522203642>** 5/23/2020, 5:15 PM
🔥🔥

AS **Austin Storms <+19853776257>** 5/23/2020, 5:28 PM
No doubt

AS **Austin Storms <+19853776257>** 2/28/2021, 1:06 PM
Yo

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:07 PM
Yo - love that thread today man

AS **Austin Storms <+19853776257>** 2/28/2021, 1:07 PM
Thanks dude. I've been heavy in the weeds for the past year trying to sort out the energy + mining relationship

AS **Austin Storms <+19853776257>** 2/28/2021, 1:07 PM
The GAM stuff is wild - have been on ND 20+ days this month deploying on wellpads

AS Austin Storms <+19853776257> 2/28/2021, 1:08 PM
You saw that wildness in ERCOT a few weeks ago?

BH Ben Hakes <+19522203642> 2/28/2021, 1:08 PM
Freakin love it

BH Ben Hakes <+19522203642> 2/28/2021, 1:08 PM
Yeah - that was insane

AS Austin Storms <+19853776257> 2/28/2021, 1:09 PM
Not a good week to be a Bitcoin miner down there

AS Austin Storms <+19853776257> 2/28/2021, 1:09 PM
There, MISO, or SPP

BH Ben Hakes <+19522203642> 2/28/2021, 1:10 PM
For sure, and you've got to send it all to the grid at $9000 per MWh of w/e the heck it got to

AS Austin Storms <+19853776257> 2/28/2021, 1:10 PM
Laughed at "For sure, and you've got to send it all to the grid at $9000 per MWh of w/e the heck it got to"

AS Austin Storms <+19853776257> 2/28/2021, 1:10 PM
Too bad Denis and team at GlidePath didn't go with the M20S pilot they would've ROI'd so quickly

BH Ben Hakes <+19522203642> 2/28/2021, 1:10 PM
Lol

AS Austin Storms <+19853776257> 2/28/2021, 1:11 PM
Not many people doing demand response with PPA/POA on ERCOT

BH Ben Hakes <+19522203642> 2/28/2021, 1:11 PM
You think that'll change?

AS Austin Storms <+19853776257> 2/28/2021, 1:11 PM
Not effectively at least - Lancium locked it all up with a patent and they're a bunch of fucking morons

BH Ben Hakes <+19522203642> 2/28/2021, 1:11 PM
Wtf

BH Ben Hakes <+19522203642> 2/28/2021, 1:11 PM
That's shitty

AS Austin Storms <+19853776257> 2/28/2021, 1:12 PM
Confidentially, I'm challenging it in federal court.

Suit should be filed soon.

BH Ben Hakes <+19522203642> 2/28/2021, 1:12 PM
Damn! I'll get the popcorn ready...

AS Austin Storms <+19853776257> 2/28/2021, 1:13 PM
Because I tried to sell it to him 6 months before he applied for the patent and he filed another patent that was recently published but not granted for the behind the meter application that was *exactly* what I tried to sell to him with the BearBox LaaS software and hardware integration I built

BH Ben Hakes <+19522203642> 2/28/2021, 1:14 PM

What a dick

AS **Austin Storms <+19853776257>** 2/28/2021, 1:14 PM
Yea I know dude, I'm going for his neck and will blackball him out of the entire industry - no bad actors.

AS **Austin Storms <+19853776257>** 2/28/2021, 1:14 PM
What have you been up to?

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:17 PM
Still working for this AgTech startup in Minny. Got promoted to lead iOS eng after some attrition. Working on a couple side projects and recently have been talking with Alex and River about joining them.

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:19 PM
We moved too so I went heavy into the home gym setup.

Image: ~/Library/SMS/Attachments/85/05/92A4C40B-5F9C-4C38-8B63-F692E90FCA6C/IMG_2403.jpeg (3 MB)

AS **Austin Storms <+19853776257>** 2/28/2021, 1:19 PM
Loved "Still working for this AgTech startup in Minny. Got promoted to lead iOS eng after some attrition. Working on a couple side projects and recently have been talking with Alex and River about joining them."

AS **Austin Storms <+19853776257>** 2/28/2021, 1:19 PM
Loved an image

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:20 PM
Hopefully we don't need another car for a while.

AS **Austin Storms <+19853776257>** 2/28/2021, 1:20 PM
Love that! The River team is very good tmk

AS **Austin Storms <+19853776257>** 2/28/2021, 1:20 PM
And home gyms were more scarce than Bitcoin last year - glad you got one setup!

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:22 PM
Yeah man - paying the shipping costs on my bumper plates felt like paying shipping for some ASICS

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:23 PM
If you ever come through Minny hit me up and we can workout

AS **Austin Storms <+19853776257>** 2/28/2021, 1:23 PM
Hahaha I bet - it's been brutal getting things out of China for the last year

AS **Austin Storms <+19853776257>** 2/28/2021, 1:23 PM
Liked "If you ever come through Minny hit me up and we can workout"

AS **Austin Storms <+19853776257>** 2/28/2021, 1:24 PM
Absolutely dude - would love to crush some burpees in there

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:24 PM
Lol

AS **Austin Storms <+19853776257>** 2/28/2021, 1:25 PM
And lmk how it goes with the River stuff - we're about to start expanding our core team and I could always use another software engineer, I'm currently writing everything hahaha

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:26 PM
Liked "And lmk how it goes with the River stuff - we're about to start expanding our core team and I could always use another software engineer, I'm currently writing everything hahaha"

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:28 PM
Will do. It'd be great to get back into the game, but being patient.

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:29 PM
I'm also starting to look at some part time contract work on the side with a local dev I trust a lot. If you guys ever wanted something mobile especially we could chat.

AS **Austin Storms <+19853776257>** 2/28/2021, 1:30 PM
Loved "I'm also starting to look at some part time contract work on the side with a local dev I trust a lot. If you guys ever wanted something mobile especially we could chat. "

AS **Austin Storms <+19853776257>** 2/28/2021, 1:30 PM
Always - if anything, we normally start folks with contract work to see if they are a good fit with the team culture and bring them on full-time after 12 months.

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:30 PM
Liked "Always - if anything, we normally start folks with contract work to see if they are a good fit with the team culture and bring them on full-time after 12 months."

AS **Austin Storms <+19853776257>** 2/28/2021, 1:31 PM
That's how it happened with me and I had another job full-time while I was getting paid for the side work w GAM

BH **Ben Hakes <+19522203642>** 2/28/2021, 1:32 PM
Best way to go IMHO

AS **Austin Storms <+19853776257>** 2/28/2021, 1:33 PM
Agreed

BH **Ben Hakes <+19522203642>** 4/27/2021, 10:30 PM
Thought you'd like

*File **"691a4c9f-64f8-4b3e-a710-499e5b1caf46.heic"** is missing.*
Attachment: ~/Library/SMS/Attachments/5a/10/3AB95416-4476-4312-9812-5D05E9D40E70/IMG_3024.heic (46 KB)

AS **Austin Storms <+19853776257>** 4/27/2021, 10:32 PM
Hahaha very accurate

AS **Austin Storms <+19853776257>** 4/28/2021, 8:00 AM
FYI I filed a federal lawsuit against Lancium and McNamara two weeks ago for them patenting the demand response for Bitcoin miners with a PPA/POA... 5 months after I tried to sell him the container with all of the software and hardware integrations I'd written.

BH **Ben Hakes <+19522203642>** 4/28/2021, 10:50 AM

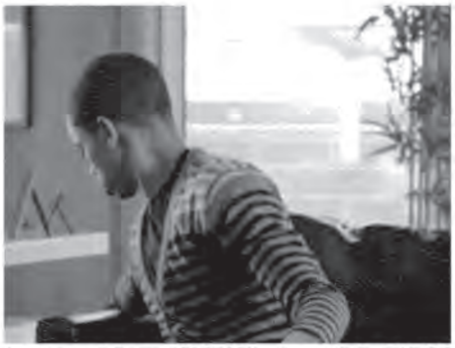

Image: ~/Library/SMS/Attachments/ed/13/6A8745FD-2CD5-4E40-BB12-57D2DF181C98/BDB48BDB-7F34-4559-89F4-7045FBB787A7.gif (3 MB)

BH **Ben Hakes <+19522203642>** 4/28/2021, 10:50 AM
Fuck 'em

BH **Ben Hakes <+19522203642>** 4/28/2021, 10:50 AM
I'll be cheering you on

AS **Austin Storms <+19853776257>** 4/28/2021, 11:46 AM
Thanks dude

EXHIBIT H

TX017
BearBox v. Lancium
21-cv-00534

PLAINTIFF'S
EXHIBIT
56
McNamara

PENGAD 800-631-6989

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
Claim 1	
A system comprising:	Layer1 has the claimed system: For example, "Layer 1 designs, produces, and operates its entire [Bitcoin] mining infrastructure, from proprietary ASIC chips and liquid-cooled mining container to wholly-owned power development and procurement." (*Ex. T, Layer1 2/19/2020*). "Layer1 builds turnkey, full-integrated Bitcoin mining data centers that boost profitability of energy assets and improve the reliability of electrical grids." *(Ex. J, Layer1.com 6/9/2020)*
[a1] a set of computing systems.	Layer1's system comprises a "set of computing systems": "Bitcoin miners are essentially the bookkeepers of the Bitcoin network, compiling transactions and adding them to 'blocks' of records published every 10 minutes. Miners earn the right to publish a block of transactions by being the first to solve a very hard, random mathematical equation known as a 'hash' or 'hashing puzzle.'" "When they win that computing race, miners are rewarded with a fixed amount of Bitcoin—currently 12.5 Bitcoin, or about $125,000." "[M]ost mining these days is at industrial scale." (*Ex. T, 2/19/2020 Fortune*) Layer1 operates "two bitcoin factories – 20-by-8 shipping containers chock full of bitcoin miners … the mining machines are immersed in vats of liquid … that keeps them cool." (*Ex. E, 2/28/2020* Forbes). These mining machines are a set of computing systems.
[a2] wherein the set of computing systems is configured to perform computational operations using power from a power grid;	Layer1's set of computing systems is configured to perform computational operations using power from the grid. "Bitcoin miners are essentially the bookkeepers of the Bitcoin network, compiling transactions and adding them to 'blocks' of records published every 10 minutes. Miners earn the right to publish a block of transactions

Layer1 Claim Chart
U.S. Patent No. 10,608,433

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	by being the first to solve a very hard, random mathematical equation known as a 'hash' or 'hashing puzzle.'" "When they win that computing race, miners are rewarded with a fixed amount of Bitcoin—currently 12.5 Bitcoin, or about $125,000." "[M]ost mining these days is at industrial scale." (*Ex. T, 2/19/2020 Fortune*). Bitcoin mining involves performing computational operations as described above. Layer1's set of computing systems are configured to utilize power from a power grid. For example, Layer1's Bitcoin mining data centers have been "steadily mining Bitcoin at [its] large-scale power infrastructure property in West Texas" since early 2020. By centralizing the consumption and release of hundreds of Megawatts of electricity per site, each of our Bitcoin mining datacenters becomes a large-scale battery." (*Ex. J*, *Layer1.com, 6/9/2020*). Layer1 obtained the capital it needed to "acquire an entire electric substation capable of handling 100 megawatts, and 30 acres of land on which they aim to install a village consisting of dozens of their container-based bitcoin factories, each of which draws 2.5 mw (enough to power more than 1,000 homes)." (*Ex. E, Forbes, 2/28/2020*) Layer1's CEO (Alexander Liegl) admitted Layer1's computing systems perform computational operations using power from a power grid, stating: "... either you can get that electricity by collocating directly with energy plants or you can, as we're currently doing, buying it off the grid through our substation and then effectively you feed your electricity to your chips which do monotonous computation ..." Leslie Lamb, EP 9: YOUR LAYER1 "LIEGL" COUNSEL, ANCHOR FM (2020), https://anchor.fm/cryptounstacked/episodes/EP-9-Your-Layer1-Liegl-Counsel-eeuq3f (at 14:47 min) (last visited Aug 13, 2020). "Layer1's model also involves coordinating with the utilities supplying the electricity in a way that the startup says can stabilize power grids. The company pays for the electricity it needs." *(Ex. K, Business Insider 8/11/20)*

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
[b] a control system configured to:	Layer1's "system" includes a "control system." "Layer1 is the first company in the global Bitcoin mining industry that can curtail large amounts of energy consumption during times of market need and release it to the grid at the push of a button." (*Ex. L*, 5/22/2020 Layer1). "Layer1 has entered into so-called "demand response" contracts whereby at a minute's notice they will shut down all their machines and instead allow their 100 mw load to flow onto the grid." (*Ex. D, Forbes, 5/21/*2020). "Through an instant software command, at the press of a button, [Layer1] can turn off dozens/hundreds of megawatts instantly. Ryan Selkis, LAYER 1 CEO ALEX LIEGL ON THE INSTITUTIONALIZATION OF MINING IN AMERICA, MESSARI.IO (2020), https://messari.io/article/layer-1-ceo-alex-liegl-on-the-institutionalization-of-mining-in-america (at 14:05 min) (last visited Aug 13, 2020). Layer1 has "the capability to participate in demand response management just because of the unique software platform that we've built." Christine Kim, CRYPTO LONG AND SHORT: A NEW MARKET PART 3 WITH ALEXANDER LIEGL, FRANK HOLMES, ETHAN VERA COINDESK.COM (2020), https://www.coindesk.com/videos/coindesk-tv-consensus-distributed/crypto-long-and-short-a-new-market-part-three-with-alexander-liegl-frank-holmes-ethan-vera (at 4:35 min) (last visited Aug 13, 2020). Layer1's proprietary "demand-response" software can be activated to stabilize the energy grid by dynamically managing its [Layer1's] electricity usage during periods of peak market demand. (*Ex. L*, 5/22/2020 Layer1). The ability to shut down its Bitcoin mining machines "at a minute's notice" and "dynamically manage" its energy usage demonstrates that Layer1 utilizes a control system.
[b1] monitor a set of conditions;	Layer1's control system is configured to "monitor a set of conditions":

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	"Layer1 has entered into so-called "demand response" contracts whereby at a minute's notice they will shut down all their machines and instead allow their 100 mw load to flow onto the grid." (*Ex. D, Forbes, 5/21/*2020). Layer1's proprietary "demand-response" software can be activated to stabilize the energy grid by dynamically managing its [Layer1's] electricity usage during periods of peak market demand. (*Ex. L*, 5/22/2020 Layer1). Layer1 maintains that it "is the first company in the global Bitcoin mining industry that can curtail large amounts of energy consumption during times of market need and release it to the grid at the push of a button. …." (*Ex. L, PRNewswire, 5/22/2020*) Layer1's stated ability to "dynamically manage" its electricity usage during periods of peak market demand and release its energy load to the grid at the push of a button indicates the ability to monitor a set of conditions, such as the market demand for electricity, frequency of the grid, price of electricity, etc. Monitoring certain conditions such as hash rate, price, and power is part of Layer1's arbitrage software functionality. "There's a power arbitrage opportunity as well. In the summertime when air conditioners in Dallas, Houston and Austin are going full tilt, Texas electricity prices sometimes surge to nosebleed levels. When that happens, Layer1 will be able to make more money by shutting off its mining machines and allowing the power to flow through its substation to the grid. "'We can stabilize the grid by selling capacity for curtailment at the push of a button," says Liegl.'" (*Ex. E, Forbes, 2/28/2020*). "Bitcoin Mining Arbitrage Stack: 1) Fixed Price Power Contract; 2) Grid Congestion Hedge; 3) Forward Sell CLR Capacity; 4) Bitcoin Futures; 5) Hashrate Futures." (*Ex. M*, 8/3/2020 tweet). Layer1 monitors at least hash rate and price in conjunction with their arbitrage activities. *See, e.g.*, Christine Kim, CRYPTO LONG AND SHORT: A NEW MARKET PART 3 WITH ALEXANDER LIEGL, FRANK

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	HOLMES, ETHAN VERA COINDESK.COM (2020), https://www.coindesk.com/videos/coindesk-tv-consensus-distributed/crypto-long-and-short-a-new-market-part-three-with-alexander-liegl-frank-holmes-ethan-vera (at 2:00 min) (last visited Aug 13, 2020). "And since it's a refinery business you benefit from output multiplicity. Power, hashrate, bitcoin. Multi-variate capital allocation problem to create something scalable across those vectors." (*Ex. N*, 8/7/2020 tweet).
[b2(i)] receive power option data based, at least in part, on a power option agreement	Layer1's control system is configured to "receive power option data based, at least in part, on a power option agreement." Upon information and belief, the control system receives power option data from at least the Electric Reliability Council of Texas ("ERCOT"), which operates the electric grid and manages the deregulated market for 75 percent of the state. Alex Liegl stated: "… some entity like ERCOT can call on us and in the course of 5 minutes … through an instant software command at the press of a button we can turn off you know dozens/hundreds of megawatts instantly. So effectively, it's a big energy arbitrage play …" Ryan Selkis, LAYER 1 CEO ALEX LIEGL ON THE INSTITUTIONALIZATION OF MINING IN AMERICA, MESSARI.IO (2020), https://messari.io/article/layer-1-ceo-alex-liegl-on-the-institutionalization-of-mining-in-america (at 13:59 min) (last visited Aug 13, 2020). Upon information and belief, "Layer1 has entered into so-called "demand response" contracts whereby at a minute's notice they will shut down all their machines and instead allow their 100 mw load to flow onto the grid." (*Ex.* D, *Forbes, 5/21/2020*). Layer1's proprietary "demand-response" technology is "based on the energy market standards developed by the

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	Electric Reliability Council of Texas (ERCOT)." (*Ex. L, PRNewswire, 5/22/2020*). Layer1's CEO (Alex Liegl) notes that "[p]hysical power plants take days to turn on/off power and can only in-/decrease output in inefficient bulky increments (>1MW) … [v]irtual power plants instantly turn on/off power and can in-/decrease output in efficient hyper-granular increments (1kW) = 1000x improvement" (*Ex.* O, 5/27/2020 tweet). "Software command instantly decreases or increases many megawatts of electricity and #bitcoin hashrate to stabilize power grids:"  (*Ex. G*, 6/7/2020 tweet). "L1 virtual power plant data centers [*i.e.*, Bitcoin mining facilities] shut down during peaks for a discounted overall $MWh power price." (*Ex.* P, *6/8/2020 tweet*). Upon information and belief, Layer1's "demand-response" contracts are power option agreements (POA) and Layer1's system receives power option data (*e.g.*, minimum power threshold(s) associated with one or more time intervals for the load to operate at in accordance with/based on the POA, other constraints that its data centers should operate in accordance with, indications of a monetary penalty that would be imposed on the data centers for failure to operate as agreed upon in the POA, indications of a monetary benefit provided to the load operating at power consumption levels in accordance with the POA, one or more maximum power thresholds and corresponding time intervals for those thresholds, and/or the frequency at which the grid is operating) based, at least in part, on the power option agreement(s).

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	Layer1 has "the capability to participate in demand response management just because of the unique software platform that we've built." Christine Kim, CRYPTO LONG AND SHORT: A NEW MARKET PART 3 WITH ALEXANDER LIEGL, FRANK HOLMES, ETHAN VERA COINDESK.COM (2020), https://www.coindesk.com/videos/coindesk-tv-consensus-distributed/crypto-long-and-short-a-new-market-part-three-with-alexander-liegl-frank-holmes-ethan-vera (at 4:35 min) (last visited Aug 13, 2020). Upon information and belief, a system operating as a Controllable Load Resource (CLR) receives power option data as part of a power option agreement. Layer1's system is operating as a Controllable Load Resource (CLR) within the ERCOT market. (*Ex. F*, 8/1/2020 tweet).
[b2(ii)] wherein the power option data specify: (i) a set of minimum power thresholds and (ii) a set of time intervals.	*See* [b2(i)] above. Layer1's system is operating as a Controllable Load Resource (CLR) within the ERCOT market. (*Ex. F*, 8/1/2020 tweet), which, upon information and belief, requires, among other things, that Layer1 receive a set of minimum power thresholds (typically in MWs) for Layer1 data centers (the Load) to operate) over a set of time intervals (e.g., CLR base points every 5 minutes) with intermediate thresholds provided at, for example, 5 second intervals (e.g., CLR updated base points) to define the path for Layer1's data centers to ramp to the scheduled minimum power threshold. Upon information and belief, Layer1 has demonstrated its system's ability to receive and respond to power option data that includes a varying set of minimum power thresholds (in MW) corresponding to a set of time intervals (in seconds) through its substation.

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	 (*Ex. Q*, 6/17/2020 tweet). Upon information and belief, Layer1 also employed or employs other types of Load Response programs which also meet this limitation.
[b2(iii)] wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;	*See* above.
[c1] responsive to receiving the power option data, determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions,	Layer1's control system is configured to be "responsive to receiving the power option data, determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions" Layer1's system employs bitcoin miners as computing systems. *See* "a set of computing systems" above. Upon information and belief. Layer1's system determines a performance strategy for their computing systems, including, for example, specifying operating modes, power on/off, and/or standby states for groups of miners in order to provide a granular response to meet the power option data power thresholds.

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	Upon information and belief, in order to determine such a performance strategy, Layer1's system must necessarily monitor current conditions including, for example, operating modes, power on/off, and/or standby states of the computing systems. Upon information and belief, Layer1's systems also consider other conditions such as hash rate, price, and power. *See* "monitor a set of conditions" above. Layer1 states that their "[v]irtual power plants instantly turn on/off and can in-/decrease output in efficient hyper-granular increments (1kW) . . . ." (*Ex. O, 5/27/2020 Tweet*). More specifically, Layer1's "[b]itcoin mining provides granularity in demand-response that alternatives can not. Miners can be shut down in batches, providing the precise wattage the grid needs." (*Ex. R, Arvanaghi 6/10/2020 11:02AM Tweet*). Additionally, "Layer1 has entered into so-called "demand response" contracts whereby at a minute's notice they will shut down all their machines and instead allow their 100 mw load to flow onto the grid." (*Ex. D, Forbes, 5/21/*2020). Layer1's proprietary "demand-response" software can be activated to stabilize the energy grid by dynamically managing its [Layer1's] electricity usage during periods of peak market demand. (*Ex. L*, 5/22/2020 Layer1). "'If there is an insufficiency of supply we can shut down.' The best part, they get paid whether a grid emergency occurs or not. Just for their willingness to shut in Bitcoin production, Layer1 collects an annual premium equating to $19 per megawatthour of their expected power demand — or about $17 million." (*Ex. D, Forbes, 5/21/2020*). To accomplish the above functionality, Layer1, on information and belief, receives power option data (*e.g.*, one or more of at least the minimum power threshold(s) associated with one or more time intervals for the load to operate at in accordance with/based on the POA, other constraints that

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	its data centers should operate in accordance with, indications of a monetary penalty that would be imposed on the data centers for failure to operate as agreed upon in the POA, indications of a monetary benefit provided to the load operating at power consumption levels in accordance with the POA, one or more maximum power thresholds and corresponding time intervals for those thresholds, and/or the frequency at which the grid is operating) and determines a performance strategy based on a portion of the power option data and one or more conditions (*e.g.*, current, future, and past prices for power, power availability, current and/or predicted weather conditions, data center workloads, types of computing systems available within datacenters, price to obtain power at the data center, levels of power storage available and accessible at each data center, power availability (*e.g.*, power consumption ranges at a set of computing systems and/or one or more datacenters, determining source(s) of power available at a data center (BTM, grid, battery), power prices, computing system parameters, cryptocurrency prices, computational operational parameters, and/or current/predicted weather conditions).
[c2] wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals	Upon information and belief, Layer1's "performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals" Upon information and belief, Layer1 has demonstrated its system's ability to develop a performance strategy that includes power consumption targets for each interval in a varying set of minimum power thresholds (in MW) corresponding to a set of time intervals (in seconds).

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	 (*Ex. Q*, 6/17/2020 tweet). *See also* [b2(ii)] above. Upon information and belief, Layer1 also employed or employs other types of Load Response programs which also meet this limitation. Layer1's demand-response software "instantly decreases or increases many megawatts of electricity and #bitcoin hashrate to stabilize public power grids:"  (*Ex. G, 6/7/2020 Tweet*). Upon information and belief, the above graph illustrates the ability to control the power consumption to a target point over time intervals. *See also Ex. Q, 6/17/2020 Tweet*) (showing Layer1's controlled power levels in one second intervals).
[c3] wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and	Upon information and belief, as a Controllable Load Resource (CLR) within the ERCOT market, (*Ex. F*, 8/1/2020 tweet), Layer1's system controls Layer1's load such that the power consumption target for Layer1's computing load, for each associated time interval, equals the

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	base point and base point updates thresholds set by ERCOT. *See* [b(2)(iii) – c(2) above]. Upon information and belief, Layer1 has demonstrated its system's ability to develop a performance strategy that includes power consumption targets for each interval in a varying set of minimum power thresholds (in MW) corresponding to a set of time intervals (in seconds).  (*Ex. Q*, 6/17/2020 tweet). Additionally, upon information and belief, due to control lag, Layer1's power consumption target may necessarily be greater than the minimum power threshold as the system ramps down to meet a base point threshold. *See, e.g.,* graph above around and immediately preceding time 3:00. Upon information and belief, Layer1 also employed or employs other types of Load Response programs which also meet this limitation. Layer1's demand-response software "instantly decreases or increases many megawatts of electricity and #bitcoin hashrate to stabilize public power grids:"

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	 (*Ex. G, 6/7/2020 Tweet*). Upon information and belief, the above graph illustrates the ability to control the power consumption to a target point over time intervals. *See also Ex. Q, 6/17/2020 Tweet*) (showing Layer1's controlled power levels in one second intervals prior to their announcement as a CLR on July 31, 2020).
[d] provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.	Layer1's control system is configured to "provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy." Upon information and belief, Layer1's control system can, based on the performance strategy discussed above, provide instructions to the set of computing systems, for example, to turn on and/or to enter a higher power state, and therefore perform on or more computational operations. Layer1 states that their "[v]irtual power plants instantly turn on/off and can in-/decrease output in efficient hyper-granular increments (1kW) . . . ." (*Ex. O, 5/27/2020 Tweet*). More specifically, Layer1's "[b]itcoin mining provides granularity in demand-response that alternatives cannot. Miners can be shut down in batches, providing the precise wattage the grid needs." (*Ex. R, Arvanaghi 6/10/2020 11:02AM Tweet*). Layer1 further states that it can "stabilize the grid by selling capacity for curtailment at the push of a button." (*Ex. E, Forbes 2/28/2020*). "Virtual power plants instantly turn on/off power and can in-/decrease output in efficient hyper-granular increments (1kW) = 1000x improvement." (*Ex. O*, 5/27/2020 *Tweet*). Layer1's "[s]oftware command' instantly decreases

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	or increases many megawatts of electricity and #bitcoin hashrate to stabilize public power grids:"  (*Ex. G, 6/7/2020 Tweet*).
Claim 2	
The system of claim 1,	*See claim 1, preamble*
wherein the control system is configured to monitor the set of conditions comprising:	*See claim 1, elements [b] and [b1]*
[a] a price of power from the power grid; and	Upon information and brief, Layer1 monitors, for example, the price of power from the grid so as to determine whether to, at least, turn on/off power and/or increase/decrease output. (*Ex. O, 5/27/2020 Tweet*) *See also claim 1, element [b1].*
[b] a plurality of parameters associated with one or more computational operations to be performed at the set of computing systems.	Layer1, upon information and belief, Layer1's control system is configured to monitor more than one parameter associated with the computational operations performed at its Bitcoin mining data centers, for example, monitoring conditions such as hash rate, price, and power is part of Layer1's arbitrage software functionality. *See claim 1, element [b1].* Additionally, Layer1 virtual power plant data centers (*i.e.*, Bitcoin mining facilities) shut down during peaks for a discounted overall \$/MWh power price. (*Ex. P, 6/8/2020 Tweet*). As noted by Forbes, "[t]here's a power arbitrage opportunity as well. In the summertime when air conditioners in Dallas, Houston and Austin are going full tilt, Texas electricity prices sometimes surge to nosebleed levels. When that happens, Layer1 will be

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	able to make more money by shutting off its mining machines and allowing the power to flow through its substation to the grid. 'We can stabilize the grid by selling capacity for curtailment at the push of a button,' says Liegl." (*Ex. E, 2/28/2020 Forbes*). Layer1 thus must be able to determine when it is more profitable to bitcoin mine and when it is more profitable to shut down. To make such a determination, Layer1, on information and belief, monitors, for example, the price of power, and parameters (e.g. cost) associated with its computational operations.
Claim 3	
The system of claim 2,	
wherein the control system is configured to:	
determine the performance strategy for the set of computing systems based on a combination of at least the portion option data, the price of power from the grid, and the plurality of parameters associated with one or more computational operations.	Layer1's system determines a performance strategy based, at least in part, on power option data. *See claim 1, element [c1]*. Upon information and belief, Layer1's system determines a performance strategy based, at least in part, on the price of power from the grid. *See claim 2, elements [a] and [b]*. Upon information and belief, Layer1's system determines a performance strategy based, at least in part, the plurality of parameters associated with one or more computational operations. Layer1 thus must be able to determine when it is more profitable to bitcoin mine and when it is more profitable to shut down. To make such a determination, Layer1, on information and belief, monitors, for example, the price of power, and parameters (e.g. cost) associated with its computational operations. *See claim 2, elements [a] and [b]*.
Claim 6	
The system of claim 1,	*See claim 1, preamble*
wherein the control system is further configured to:	*See claim 1*

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
[a] receive subsequent power option data based, at least in part, on the power option agreement,	Layer1's control system is further configured to receive subsequent power option data based, at least in part, on the power option agreement. For example, upon information and belief, as a CLR (*see claim 1, element [b(2)(i)]*) Layer1's system receives, as power option data, CLR base points every 5 minutes and, additionally, updated base points every 5 seconds to guide Layer1's load ramping. *See claim 1, element [b(2)(ii)]*. Additionally, upon information and belief, such base point data may be interspersed with primary frequency response data as a condition of participating as a CLR. Upon information and belief, Layer1's control system is not limited to a one-time event. Upon information and belief, Layer1's control system, therefore, is further configured to receive subsequent (*e.g.*, later in time or in operation) power option data that is based in part on the demand-response contract(s) (POA(s)).
[b] wherein the subsequent power option data specify to decrease one or more minimum power thresholds of the set of minimum power thresholds.	Upon information and belief, base point data transmitted as part of CLR power option data can specify increased or decreased base points or updated base points. *See, e.g.*, Layer1's chart of power thresholds:  (*Ex. Q*, 6/17/2020 tweet).

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	Accordingly, upon information and belief, subsequent power option data can specify a decrease in one or more minimum power thresholds.
Claim 7	
The system of claim 6,	*See claim 6, preamble*
wherein the control system is further configured to:	*See claim 6*
[a] responsive to receiving the subsequent power option data, modify the performance strategy for the set of computing systems based on a combination of at least the portion of the subsequent power option data and at least one condition in the set of conditions	*See claim 6, elements [a] and [b], claim 1, element [c1]*
[b] wherein the modified performance strategy comprises one or more reduced power consumption targets for the set of computing systems.	Upon information and belief, Layer1 has demonstrated its system's ability to develop a performance strategy that includes power consumption targets for each interval in a varying set of minimum power thresholds (in MW) corresponding to a set of time intervals (in seconds).  (*Ex. Q*, 6/17/2020 tweet). Upon information and belief, as Layer1's system receives subsequent power option data, *see claim 6, element [a]*, the system can set a reduced power consumption target for the set of computing system to meet the power threshold(s). *See claim 1, element [c3].*

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
Claim 8	
The system of claim 7,	*See claim 7*
wherein the control system is further configured to:	*See claim 7*
provide instructions to the set of computing systems to perform the one or more computational operations based on the modified performance strategy.	*See claim 1[d].*
Claim 9	
The system of claim 1,	*See claim 1, preamble*
wherein the control system is a remote master control system positioned remotely from the set of computing systems.	Layer1's system includes multiple 40' x 20' containers, with each container containing computing systems. Leslie Lamb, EP 9: YOUR LAYER1 "LIEGL" COUNSEL, ANCHOR FM (2020), https://anchor.fm/cryptounstacked/episodes/EP-9-Your-Layer1-Liegl-Counsel-eeuq3f (at 10:13 min) (last visited Aug 13, 2020). It is not uncommon to locate master control systems remotely from the computer systems being controlled.
Claim 11	
The system of claim 1,	*See claim 1, preamble*
wherein the control system is configured to receive the power option data while monitoring the set of conditions.	Upon information and belief, Layer1's control system must be configured to receive the power option data while monitoring the set of conditions. According to Alex Liegl, "[s]oftware command ***instantly*** decreases or increases many megawatts of electricity and #bitcoin hashrate to stabilize public power grids." (*Ex. G, 6/7/2020 Tweet*). To achieve such control, there should be minimal (if any) delay between control system receiving the power option data and the control system monitoring the set of conditions.
Claim 12	
The system of claim 1,	*See claim 1, preamble*
wherein the control system is further configured to:	*See claim 1*

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
provide a request to a qualified scheduling entity (QSE) to determine the power option agreement;	Upon information and belief, Layer1's system engages in power arbitrage. *See claim 1, element [b(1)].* Upon information and belief, to be able to engage in arbitrage, for example in ERCOT, Layer1's system must be able to submit a load bid through a QSE in order to receive (e.g., determine) a power option agreement as an operational CLR. Upon information and belief, Layer1 has demonstrated the ability to submit load bids through a QSE.  The above image tweeted by Alex Liegl, upon information and belief, is a QSE screen, and according to Alex Liegl, purports to show Layer1's system as an operational 1MW CLR. (*Ex. F*, 8/1/2020 tweet) Additionally, upon information and belief, a load resource can submits bids in ERCOT's day-ahead market and in response to SCED dispatches, which are other demand response programs. As a load resource, upon information and belief, Layer1 also employed or employs other types of

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
	Load Response programs which also meet this limitation. *See claim 1, elements [b(1], [b(2)(1)], and [c(3)].*
and receive power option data in response to providing the request to the QSE.	Upon information and belief, upon receiving (e.g., determining) a power option agreement, Layer1 receives power data. *See claim 1, element [b(2)(i)].*
Claim 13	
The system of claim 1, wherein the power option data specify:	*See claim 1, preamble*
[a] (i) a first minimum power threshold associated with a first time interval in the set of time intervals, and (ii) a second minimum power threshold associated with a second time interval in the set of time intervals	*See claim 1, elements [b2(i) and b2(ii)].* Layer1 states that "[v]irtual power plants instantly turn on/off and can in-/decrease output in efficient hyper-granular ***increments*** (1kW)…." (*Ex. O, 5/27/2020 Tweet*). The capability to increase or decrease in "increments" is evidence that Layer1's control system utilizes power thresholds associated with multiple time intervals.
[b] wherein the second time interval is subsequent to the first time interval.	A second timer interval is normally considered to occur subsequent to a first time interval.
Claim 14	
The system of claim 13, wherein the control system is configured to:	*See claim 13*
[a] determine the performance strategy for the set of computing systems such that the performance strategy comprises:	*See claim 1, element [c1]*
[b] a first power consumption target for the set of computing systems for the first time interval, wherein the first power consumption target is equal to or greater than the first minimum power threshold; and	*See claim 1, elements [c2 and c3] and claim 13*
[c] a second power consumption target for the set of computing systems for the second time interval, wherein the second power consumption target is equal to or greater than the second minimum power threshold.	*See claim 1, elements [c2 and c3] and claim 13*

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
Claim 15	
The system of claim 1,	*See claim 1, preamble*
wherein a total duration of the set of time intervals corresponds to a twenty-four hour period.	Upon information and belief, because one of the durations that ERCOT accepts for load bidding corresponds to a twenty-four hour period, at least some of Layer1's total duration of the set of time intervals correspond to a twenty-four hour period.
Claim 16	
The system of claim 1, wherein the set of conditions monitored by the control system further comprise:	*See claim 1, preamble and elements [b] and [b1]*
[a] a price of power from the power grid; and	*See claim 3.* Additionally, Layer1 states there is a power arbitrage opportunity. When electricity prices are high, Layer1 will be able to make more money by shutting off its mining machines and allowing the power to flow through its substation to the grid. (*Ex. E,* 2/28/2020 Forbes). To make this determination, Layer1, upon information and belief, monitors the price of power from the power grid.
[b] a global mining hash rate and a price for a cryptocurrency; and wherein the control system is configured to:	*See element [a], above.* Upon information and belief, Layer1 must also monitor the global mining hash rate and a price for cyptocurrency (*e.g.*, Bitcoin) to make the determination whether it will make more money from bitcoin mining or from selling capacity for curtailment. Because Layer1 contends it can make these determinations (*e.g.*, whether to mine or shout off its machines) in real time (or near real time), it also monitors these set of conditions.
[c] determine the performance strategy for the set of computing systems based on a combination of at the portion of the power option data, the price of power from the power grid, the global mining hash rate and the price for the cryptocurrency,	*See, e.g., element [b] above, claim 1, element [c1], claim 3.*
[d] wherein the performance strategy specifies for at least a subset of the set of computing systems to perform mining operations for the cryptocurrency when the price	Layer1 states that its software can "instantly decrease[] or increase[] many megawatts of electricity and #bitcoin hashrate to stabilize public power grids." (*Ex.* G, 6/7/2020 Tweet). Layer1's increasing the bitcoin hash rate,

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.	on information and belief, evidences its ability to control a subset of the set of computing systems to perform mining operations. *See, also, claim 1, element [d]* (granular control of a subset of the set of computing systems.)
Claim 17	
A method comprising:	
[a] monitoring, by a computing system, a set of conditions;	*See claim 1, elements [a1] and [b1].*
[b1(i)] receiving, at the computing system, power option data based, at least in part, on a power option agreement	*See claim 1, element [b2(i)]*
[b1(ii)] wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals,	*See claim 1, element [b2(ii)]*
[b1(iii)] wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;	*See claim 1, element [b2(iii)]*
[b2(i)] responsive to receiving the power option data, determining a performance strategy for a set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions,	*See claim 1, element [c1]*
[b2(ii)] wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals,	*See claim 1, element [c2]*
[b2(iii) wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and	*See claim 1, element [c3]*

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
[c] providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.	*See claim 1, element [d]*
Claim 18	
The method of claim 17,	
wherein determining the performance strategy for the set of computing systems comprises:	*See claim 17*
identifying information about the set of computing systems;	Layer1 identifies information about the set of computing systems. For example, Layer1 identifies, at least, the power consumption of the set of computing systems and the bitcoin hashrate of the set of computing systems. (*Ex. G*, 6/7/2020 Tweet).
and determining the performance strategy to further comprise instructions for at least a subset of the set of computing systems to operate at an increased frequency based on a combination of at least the portion of the power option data and the information about the set of computing systems.	Upon information and belief, Layer1's system uses bitcoin miners that can operate at multiple frequencies. For example, the common AntMiner S9 can operate at 550 MHz, 600 MHz, or 650 MHZ. (Ex. S, Antminer S9 Installation Guide, page 6). Upon information and belief, Layer1's system adjusts the operation of a subset of their computing systems to achieve granularity. Layer1 states that their "[v]irtual power plants instantly turn on/off and can in-/decrease output in efficient hyper-granular increments (1kW)…." (*Ex. O, 5/27/2020 Tweet*). Upon information and belief, Layer1 increases output, and therefore load, in hypergranular increments by operating miners at an increased frequency.
Claim 19	
The method of claim 17, further comprising	
[a1] receiving subsequent power option data based, at least in part, on the power option agreement,	*See claim 6, element [a]*
[a2] wherein the subsequent power option data specify to decrease one or more minimum power thresholds of the set of minimum power thresholds;	*See claim 6, element [b]*

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
[b1(i)] responsive to receiving the subsequent power option data, modifying the performance strategy for the set of computing systems based on a combination of at least the portion of the subsequent power option data and at least one condition in the set of conditions,	*See claim 7, element [a]*
[b1(ii)] wherein the modified performance strategy comprises one or more reduced power consumption targets for the set of computing systems; and	*See claim 7, element [b]*
[c] providing instructions to the set of computing systems to perform the one or more computational operations based on the modified performance strategy.	*See claim 8 and claim 1, element [d]*
Claim 20	
A non-transitory computer readable medium having stored therein instructions executable by one or more processors to cause a computing system to perform functions comprising:	Upon information and belief, Layer1's system utilizes a non-transitory computer readable medium having instructions executable by one or more processors to cause a computing system to perform multiple functions, including those set forth below.
[a] monitoring a set of conditions;	*See claim 1, elements [a1], [b], and [b1]*
[b1(i)] receiving power option data based, at least in part, on a power option agreement,	*See claim 1, element [b2(i)]*
[b1(ii) wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals,	*See claim 1, element [b2(ii)]*
[b1(iii)] wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;	*See claim 1, element [b2(iii)]*
[c1] responsive to receiving the power option data, determining a performance strategy for a set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions,	*See claim 1, element [c1]*

Layer1 Claim Chart
U.S. Patent No. 10,608,433

Exemplary Asserted Claims	Layer1's Infringement
[c2] wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals,	*See claim 1, element [c2]*
[c3] wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and	*See claim 1, element [c3]*
[d] providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.	*See claim 1, element [d]*

Fwd: code

From: Austin Storms <austin@bearbox.io>
To: jason@goldstarla.com
Date: Mon, 29 Apr 2019 13:36:01 -0500
Attachments: get_block_height.py (1.22 kB); ATT00002.bin (236 bytes); denis_logic_newgen.py (7.71 kB); ATT00004.bin (236 bytes); local_block_height_and_prop_times.py (2.28 kB); ATT00006.bin (236 bytes); denis_logic.py (7.7 kB); ATT00008.bin (236 bytes); test_blocks_24hrs.py (4.9 kB); ATT00010.bin (236 bytes); LMP_csv_import.py (1.69 kB); ATT00012.bin (236 bytes); DA_LMP_import.py (1.8 kB); ATT00014.bin (236 bytes); test_profit.py (4.08 kB); ATT00016.bin (236 bytes); cgminer_sqlite_test.py (6.2 kB); ATT00018.bin (236 bytes); email_alert.py (4.43 kB); ATT00020.bin (236 bytes); get_block_height_test.py (2.2 kB); ATT00022.bin (236 bytes); test_profit_efficient.py (3.73 kB); ATT00024.bin (178 bytes)

Begin forwarded message:

> **From:** Austin Storms <austin@bearbox.io>
> **Date:** April 29, 2019 at 12:36:12 PM CDT
> **To:** Austin Storms <austin@bearbox.io>
> **Subject: code**
>
> Austin M. Storms
> BearBox, LLC
> 611 O' Keefe Avenue
> New Orleans, LA 70113
> austin@bearbox.io
>
> CONFIDENTIALITY NOTICE: This email communication may contain private, confidential, or legally privileged information intended for the sole use of the designated and/or duly authorized recipient(s). If you are not the intended recipient or have received this email in error, please notify the sender immediately by email and permanently delete all copies of this email including all attachments without reading them. If you are the intended recipient, secure the contents in a manner that conforms to all applicable state and/or federal requirements related to privacy and confidentiality of such information.

TX020
BearBox v. Lancium
21-cv-00534

Metadata for source code file BB_SC00000014

File	BB_SC00000014
Filename	denis_logic.py
Date	2/16/2021 10:36
Description	Executable Script File
Orig_Folder	/1/AK-0137_EMT-00007405_L01.L01/AK-0137_EMT-00007045/Users/Admin/PycharmProjects/Mining

```
#!/usr/bin/env python3
import smtplib, ssl, socket, json, requests, urllib3, datetime, sqlite3, os, time,
logging, config
from pathlib import Path
from get_current_RT_LMP import get_real_time_LMP
from get_current_DA_LMP import get_day_ahead_LMP
from toggle_relay import *
from pymodbus.client.sync import ModbusTcpClient as ModbusClient
from bitcoin.rpc import RawProxy
from email_alert import *

urllib3.disable_warnings(urllib3.exceptions.InsecureRequestWarning)

folder = Path("C:/Users/Admin")
db_file = str(folder / "test_10.sqlite")
miner_hashrate = 14300000 * 272 * .95
kW_load = 1.3 * 272 * 1.05
location = 'EXELON4'
block_reward = 12.5

def get_BTC_price():
    try:
        price = requests.get('https://api.coinbase.com/v2/prices/spot?currency=USD')
        price_dict = price.json()
        BTC_price = price_dict['data']['amount']
        BTC_price = float(BTC_price)
        return BTC_price

    except Exception as e:
        print("Error:  " + str(e))

def get_network_difficulty():
    try:
        p = RawProxy()
        diff = float(p.getdifficulty())

        return diff

    except Exception as e:
        print("Error:  " + str(e))

def get_block_height():
    try:
        p = RawProxy()
        info = p.getblockchaininfo()
        block_height = (info['blocks'])

        return block_height

    except Exception as e:
            print("Error:  " + str(e))

def get_network_hashrate(diff):
    try:
        network_hashrate = requests.get("https://chain.so/api/v2/get_info/BTC")
        hashrate_dict = network_hashrate.json()
        hashrate = hashrate_dict['data']['hashrate']
        hashrate = float(hashrate) / 1000000
        return hashrate

    except Exception as e:
        print("Error:  " + str(e))

def get_breakeven_USD_per_kWh(miner_hashrate, hashrate, BTC_price, kW_load):
    try:
```

Exhibit
0097
5/31/2022
Baer

TX024
BearBox v. Lancium
21-cv-00534

Messages in chronological order (times are shown in GMT -04:00)

+19178332720

AS **Austin Storms <+19853776257>** 5/4/2019, 12:57 AM
Storms

MM **Michael McNamara <+19178332720>** 5/5/2019, 4:00 PM
Storms, great to meet you at the conference

This is me:

MM **Michael McNamara <+19178332720>** 5/5/2019, 4:00 PM
https://www.linkedin.com/in/michael-mcnamara-1055211

AS **Austin Storms <+19853776257>** 5/5/2019, 4:04 PM
Same here, Michael. I'm not on LinkedIn, but you've got my personal #.

I'll put some feelers out to some of my PM friends this week about what we talked about Fri night. Tty soon.

MM **Michael McNamara <+19178332720>** 5/5/2019, 4:06 PM
Thanks - that's great

I also think your boxes may have some benefits vs the ones we are doing with JB driver

Lots of stuff to collaborate on

AS **Austin Storms <+19853776257>** 5/5/2019, 7:43 PM
Absolutely. I can send you specs on the boxes/PDUs/logic design - what's your email?

MM **Michael McNamara <+19178332720>** 5/5/2019, 7:45 PM
Michael.mcnamara@lancium.com

AS **Austin Storms <+19853776257>** 5/5/2019, 7:49 PM
👍

MM **Michael McNamara <+19178332720>** 5/8/2019, 1:45 PM
Storms, can you send me those box design specs please!

AS **Austin Storms <+19853776257>** 5/8/2019, 4:31 PM
Yep! I'll put it together when I get home tonight

MM **Michael McNamara <+19178332720>** 5/8/2019, 4:31 PM
Thank you, sir

AS **Austin Storms <+19853776257>** 5/9/2019, 10:44 AM
Redoing one of the spec sheets for the newer Whatsminer models then emailing over to you

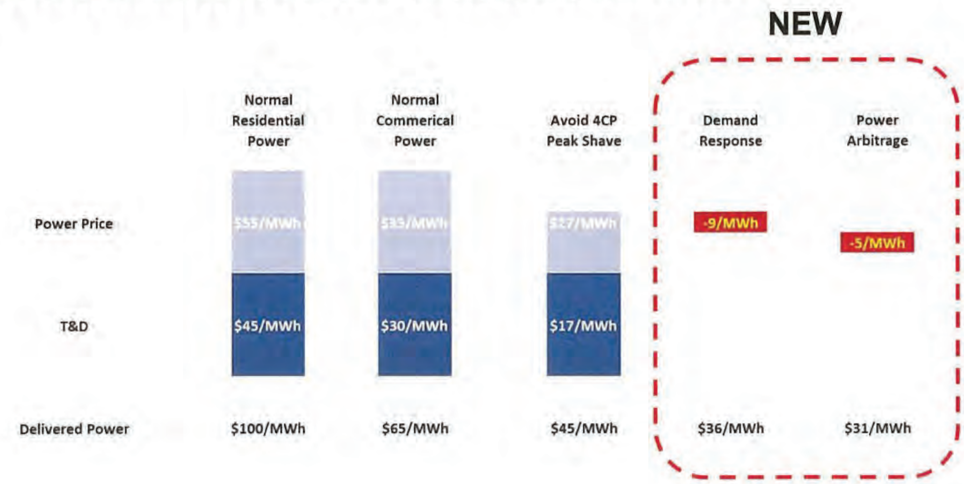
MM **Michael McNamara <+19178332720>** 5/9/2019, 10:49 AM
Great - thanks

MM **Michael McNamara <+19178332720>** 5/9/2019, 11:51 AM
Also, have you ever looked at building a GPU box?

AS **Austin Storms <+19853776257>** 5/9/2019, 11:52 AM
I haven't - but conceptually it's the same. Less electrical load density and less CFM exhaust requirements.

My First Template 2019-08-19

Discussion: New Thomas Road Power



12

Done

From: Michael McNamara <michael.mcnamara@lancium.com>
To: Raymond Cline <recline@lancium.com>, Rachel Arndt <rachel.arndt@lancium.com>, Beth Fouliard <beth.fouliard@lancium.com>
Subject: Fwd: Lancium Smart Response / September Thomas Road Power Reconicllation
Date: Fri, 25 Oct 2019 14:06:59 -0500
Importance: Normal
Attachments: Lancium_LR_Award_2019-8-23-9-23.xlsx; Lancium-_Revenue_Statement_September_2019.pdf; Lancium_September_Invoice_Settlement_File.xlsx; Power_Recon_-_Thomas_Road_-_Sept_2019_-_revised.xlsx

---

---------- Forwarded message ---------
From: **Michael McNamara** <michael.mcnamara@lancium.com>
Date: Mon, Oct 21, 2019 at 8:28 PM
Subject: Lancium Smart Response / September Thomas Road Power Reconicllation
To: タネモリ ジョナサン（SBIホールディングス）<jotanemori@sbigroup.co.jp>
Cc: Raymond Cline <recline@lancium.com>, Rachel Arndt <rachel.arndt@lancium.com>

Jonathan,

Attached please find our power reconciliation schedule (and supporting docs) for the period Aug 23rd to Sept 22nd. We need to make some adjustments to calendarize the effect and put it into the model.

I think you may find the results interesting.

We consumed just over 1 GWh of power in that period. If a normal industrial plant consumed this much power they would pay between $50,000 to $60,000.

PLAINTIFF'S EXHIBIT 44 McNamara
PENGAD 800-631-6989

Our power bill: $62.90.

Total.

Let's discuss how we got here. At the SBI site visit, we mentioned taking a number of initiatives to reduce our Thomas Road power cost:
- Fixing our power price at $34.62 per MWh with Calpine
- Engaging in Load Response Programs via MP2

Both programs worked to excellent effect in Sept. We expect them to be less profitable in the fall and winter but to be highly profitable again in the summer of 2020.

Fixing the Power Price
When we originally entered into a power marketing arrangement with Calpine at Thomas Road, we asked for the cheapest option. This involved taking "merchant" power i.e. at a floating rather than a fixed price. This seemed cheaper and we thought it would give us more flexibility. This is true but it misses a critical element. **When you fix the power price, you get the option to sell it back to the grid at the prevailing market price with Lancium keeping the spread.**

TX096
BearBox v. Lancium
21-cv-00534

From: Michael McNamara <michael.mcnamara@lancium.com>
To: Raymond Cline <recline@lancium.com>, Ian Rock <ian.rock@lancium.com>, Vitor Henrique <vitor.henrique@lancium.com>
Subject: Thomas Road Power
Date: Fri, 16 Aug 2019 15:29:57 -0400
Attachments: Thomas_Road_Power_Cosiderations.xlsx

As of today, we have a fixed price power contract with Calpine at Thomas Road for ATC power at ~$34/MWh.

This is cool. We now have two revenue sources: Bitcoin mining and selling power back to grid.

I took a crack at comparing economics. We will want to watch this closely and update regularly - probably multiple times a day.

Please take a look and we can get on a call to discuss.

--

(917) 833-2720

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41
McNamara

TX107
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21-cv-00534

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			Comment
Fixed Power Price Amount	MW	1.30	1.3MW covered now but expandable as we continue to take more power
Power Price	$/MWh	34.25	Fixed for ATC power as of 8/16/19 for 24 months
Bitcoin Price	$/BTC	10,450.00	2/16/2022
Global Hash rate	EX/s	73.00	2/16/2022

Computing Revenue			
Revenue per MWh		1	120.00
Power Price	$/MWh		34.25
T&D	$/MWh		15.00
Demand Response Revenue	$/MWh	2	(8.00)
Delivered Power Cost	$/MWh		41.25
Margin per MWh			78.75

Grid Power Revenue			Per 15 Min
Grid Price per MWh		120.00	
Power Price	$/MWh	34.25	
T&D	$/MWh	-	
Demand Response Revenue	$/MWh	-	
Delivered Power Cost	$/MWh	34.25	
Margin per MWh		85.75	

1 We will need to populate by assuming our blended machine efficiency and the BTC price and hashrate. Eventually, we should have a waterfall of all equipment with all efficiency so we know when to shut off invidual machine types
2 We should talk with MP2 regularly. Demand response revenue changes daily and we should update accordingly.

nb: Selling grid power back to grid has a higher breakeven since I THINK we won't be responsible for T&D on power we don't take

From: Michael McNamara <michael.mcnamara@lancium.com>
To: Raymond Cline <recline@lancium.com>
Subject: Re: ADK_LD1 - Lancium LR Awards.xlsx
Date: Sun, 1 Sep 2019 17:42:02 -0700
Inline-Images: image001.jpg; image002.png

Lets try to discuss tomorrow but not in group setting.

On Sun, Sep 1, 2019 at 4:26 PM Raymond Cline <recline@lancium.com> wrote:

> Yes, something I want to discuss with you as well. With LR and sellback we can take what looks like non-competitive $50-ish delivered power and obtain effective all-in rate in the mid-$20's. This is better than everything but the most elite hydro locations, and there is practically no limit. We could take locations that have power installed, but using little of it, aggregate them and control them for large virtual data centers. Uptimes would be better than at the windfarms. We may want to organically grow this business on its own timeline.
>
> The other piece would be the substation co-location that removes T&D cost. I forget the name.
>
> Raymond E. Cline Jr., PhD
> Chief Computing Officer
>
> On Sun, Sep 1, 2019 at 6:12 PM Michael McNamara <michael.mcnamara@lancium.com> wrote:
>
> > Are you getting the vague sense there is a bigger opportunity here then we realize yet?
> >
> > On Sun, Sep 1, 2019 at 3:15 PM Michael McNamara <michael.mcnamara@lancium.com> wrote:
> >
> > > This is the panel board issue? Ok, lets discuss tomorrow.
> > >
> > > On Sun, Sep 1, 2019 at 6:13 PM Raymond Cline <recline@lancium.com> wrote:
> > >
> > > > We cannot run at 2MW. This is something we need to discuss. Until we fix a major issue at Thomas Rd we are limited in the power we can safely use. We have turned all the miners to low-power mode setting to limit the amount of power draw.
> > > >
> > > > Raymond E. Cline Jr., PhD
> > > > Chief Computing Officer
> > > >
> > > > On Sun, Sep 1, 2019 at 4:40 PM Michael McNamara <michael.mcnamara@lancium.com> wrote:
> > > >
> > > > > That is interesting. How soon can we go up to scheduling the whole 2MW?
> > > > >
> > > > > On Sun, Sep 1, 2019 at 2:37 PM Raymond Cline <recline@lancium.com> wrote:
> > > > >
> > > > > > We seem to get higher award levels on the weekend and holiday. An advantage we have over with our 24x7 load over other businesses.
> > > > > >
> > > > > > Raymond E. Cline Jr., PhD
> > > > > > Chief Computing Officer
> > > > > >
> > > > > > ---------- Forwarded message ---------
> > > > > > From: **Deon Wyatt** <deon.wyatt@mp2energy.com>
> > > > > > Date: Sun, Sep 1, 2019 at 3:09 PM

TX111
BearBox v. Lancium
21-cv-00534

Δπ EXHIBIT 77
Deponent Cline
Date_____ Rptr._____
WWW.DEPOBOOKPRODUCTS.COM

Δ π EXHIBIT 74
Deponent Cline
Date____ Rptr.____
WWW.DEPOBOOKPRODUCTS.COM

ATIERED PRICE, FIXED VOLUME ELECTRICITY
with Layered Transaction Schedule (ERCOT)
Reference:
ELECTRICITY SALES AND PURCHASE AGREEMENT
Between Calpine Energy Solutions, LLC ("Seller")
And Lancium, LLC ("Buyer")
As of June 18, 2018 ("Effective Date")
Addendum Date: June 18, 2018

This Addendum (the "Addendum") supplements the Electricity Sales and Purchase Agreement referred to above (the "Agreement"). The Parties hereby agree to the terms and conditions set forth herein for Buyer's Facilities served at the Delivery Point. Capitalized terms not otherwise defined in this Addendum shall have their meanings set forth elsewhere in the Agreement, including its Appendices.

1. **PRODUCT:**
Contract Prices for Electricity set forth in this Addendum include each component identified in the table set forth below that is indicated by an [X], which are referred to collectively in this Addendum as "Electricity."

	ELECTRICITY:
☒	Electric Energy
☐	Ancillary Services (Reg-Up, Reg-Down, Responsive Reserve, and Non-Spin)
☐	ISO QSE/SC Charges and Fees
☐	RUC Make-Whole Uplift, RUC Clawback, and RUC Decommitment
☐	Distribution/Transmission Losses/UFE (collectively, "Line Losses")
☐	Locational Basis

2. **DELIVERY PERIOD:**
This Addendum shall be in full force and effect as of the Addendum Date. The terms set forth herein shall apply from the Start Date through the End Date:

Start Date:	End Date:
July 01, 2018	June 30, 2019

TX122
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21-cv-00534

3. **LOCATION AND DELIVERY POINT(S):**

Market Area	Supply Point	Delivery Point
ERCOT	Houston Trading Hub	Houston Load Zone

4. **PRICING:**

4.1 Contract Price. For each settlement interval, Buyer shall pay (i) the Fixed Price (if applicable) multiplied by the associated Fixed Price Contract Quantity (if any) for each associated Fixed Price Tier, and (ii) the Price Adder for Buyer's Total Contract Quantity. All Fixed Prices, Fixed Price Contract Quantities, and the Total Contract Quantity shall be set forth in the Layered Transaction Schedule.

Price Adder (in US $/MWh)	**$1.24**

The Contract Price(s) set forth above includes only the components set forth in Section One of this Addendum that are marked with an [X]. All other charges shall be passed through directly to Buyer. The Contract Price(s) reflects the value related to Congestion Revenue Rights.

4.2 Conversion. At any time during the term of this Addendum, the Parties may mutually agree to convert quantities priced at the real time index price to a fixed price by executing a new Layered Transaction Schedule.

4.3 Monthly Settlement. For each Location, Buyer's invoice shall reflect charges based on Buyer's usage as set forth below. If Line Losses are not included in Section 1, Buyer's metered usage shall be adjusted for Line Losses. If Line Losses are included in Section 1, the Excess Quantity shall be adjusted for Line Losses.

4.3.1 During any settlement interval, if Buyer's usage exceeds the Total Contract Quantity ("Excess Quantity"), Buyer shall pay Seller the real-time price for energy and all related delivery charges, as determined by ERCOT at the Delivery Point, plus $1.24 per MWh for the Excess Quantity. Buyer shall also pay RUC capacity short charges on the Excess Quantity. For the purpose of determining RUC capacity short charges, Buyer acknowledges that the ERCOT real time market will be considered the source for all of the Excess Quantity.

4.3.2 During any settlement interval, if Buyer's usage is less than the Total Contract Quantity ("Deficit Quantity"), Seller shall credit Buyer's account by an amount equal to the Deficit Quantity multiplied by the real-time price for energy as determined by ERCOT at the Delivery Point.

4.4 Locational Basis. For each Location, Locational Basis shall be calculated each settlement interval as an amount equal to the real time settlement point price at the Delivery Point less the real time settlement point price at the Supply Point. If the Locational Basis component is not marked as included in Section 1 above, Locational Basis shall be added to any Fixed Prices. If the Locational Basis component is not marked as included and Line Losses are marked as included in Section 1, Locational Basis shall be adjusted by the appropriate loss factor.

4.5 Changes in Circumstances

4.5.1 The Contract Price(s) and all other terms and conditions of this Addendum are established in reliance on the accuracy of information provided to Seller concerning Buyer's load requirements. Any incremental costs incurred by Seller as a result of inaccuracies in any such information provided to Seller may be passed through to Buyer.

4.5.2 The Contract Price(s) and all other terms and conditions of this Addendum are established in reliance on the existing Laws, rates, charges, independent system operator processes, market structure, congestion zone design and protocols that are in effect as of the Addendum Date. In the event of changes in the above that cause additional costs to Seller, Seller may pass through such costs to Buyer.

5. CUSTOMER PROTECTION RULES:
To the extent permitted by law, Buyer hereby waives its rights set forth in the Customer Protection Rules enacted by the Public Utility Commission of Texas (Texas Substantive Rules, Section 25.471, et seq.).

As supplemented by this Addendum including its Schedules, if any, all other Terms and Conditions contained in the Agreement remain in full force and effect.

This Addendum is subject to the Schedule(s) identified below:
Layered Transaction Schedule

Calpine Energy Solutions, LLC

Sign: Ml Rl

Print: Mark Ruggles

Title: VP Regional Pricing and Supply

LANCIUM, LLC

Sign:

Print: Jonathan Cohen

Title: Chief Financial Officer

TX125
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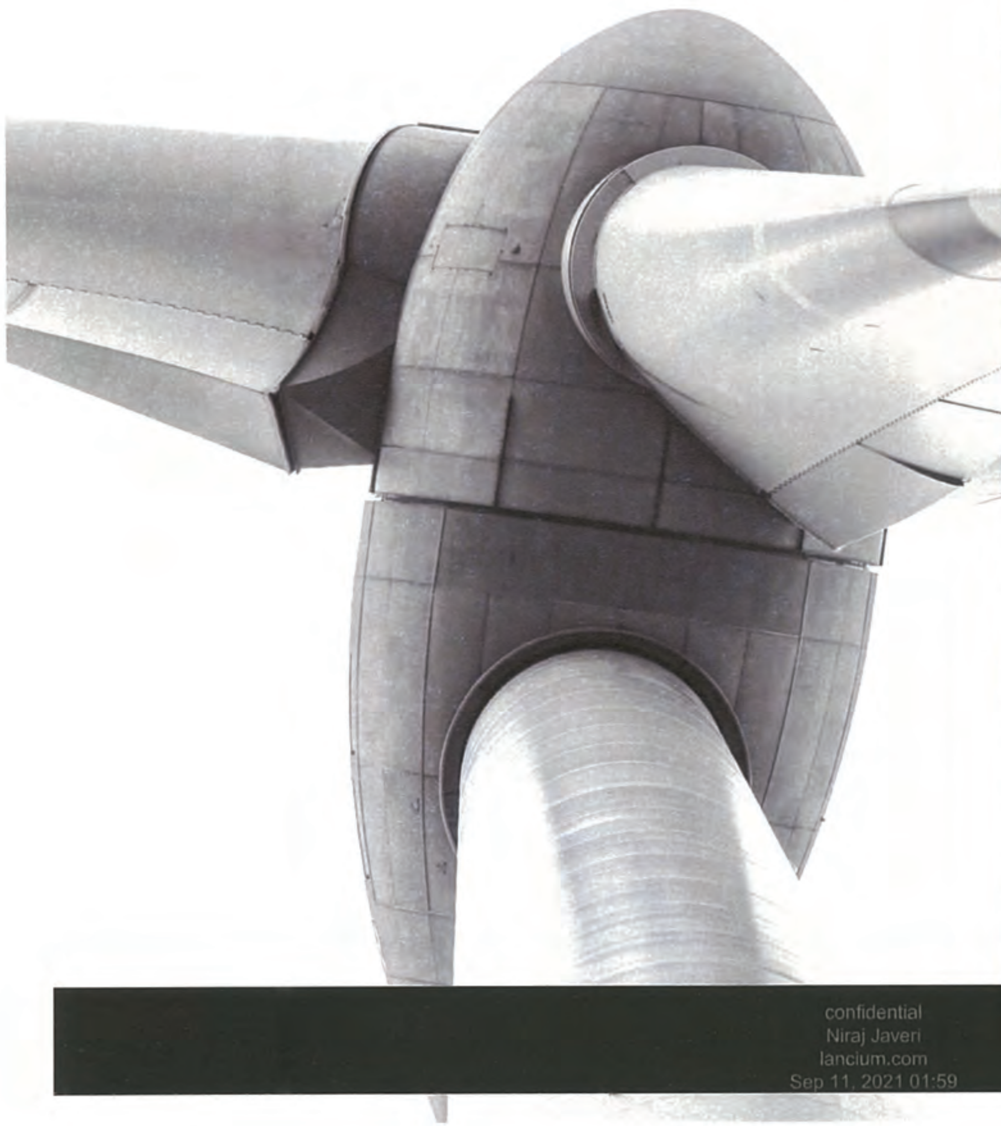

Our Mission

Lancium strives to be the leader in green, low-cost infrastructure that will power the next generation of cryptocurrency mining and other distributed energy intensive applications

Lancium infrastructure will be a key component to the decarbonized grid

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NEW YORK
65 East 55th Street
New York, NY 10022
212 593 7555

SAN FRANCISCO
Montgomery Street
6th Floor
San Francisco, CA 94111
415 248 2200

Robert Fellinger
Vice President
(415) 248-5589
rfellinger@btig.com

Austin Gregor, CFA
Associate
(212) 738-6022
agregor@btig.com

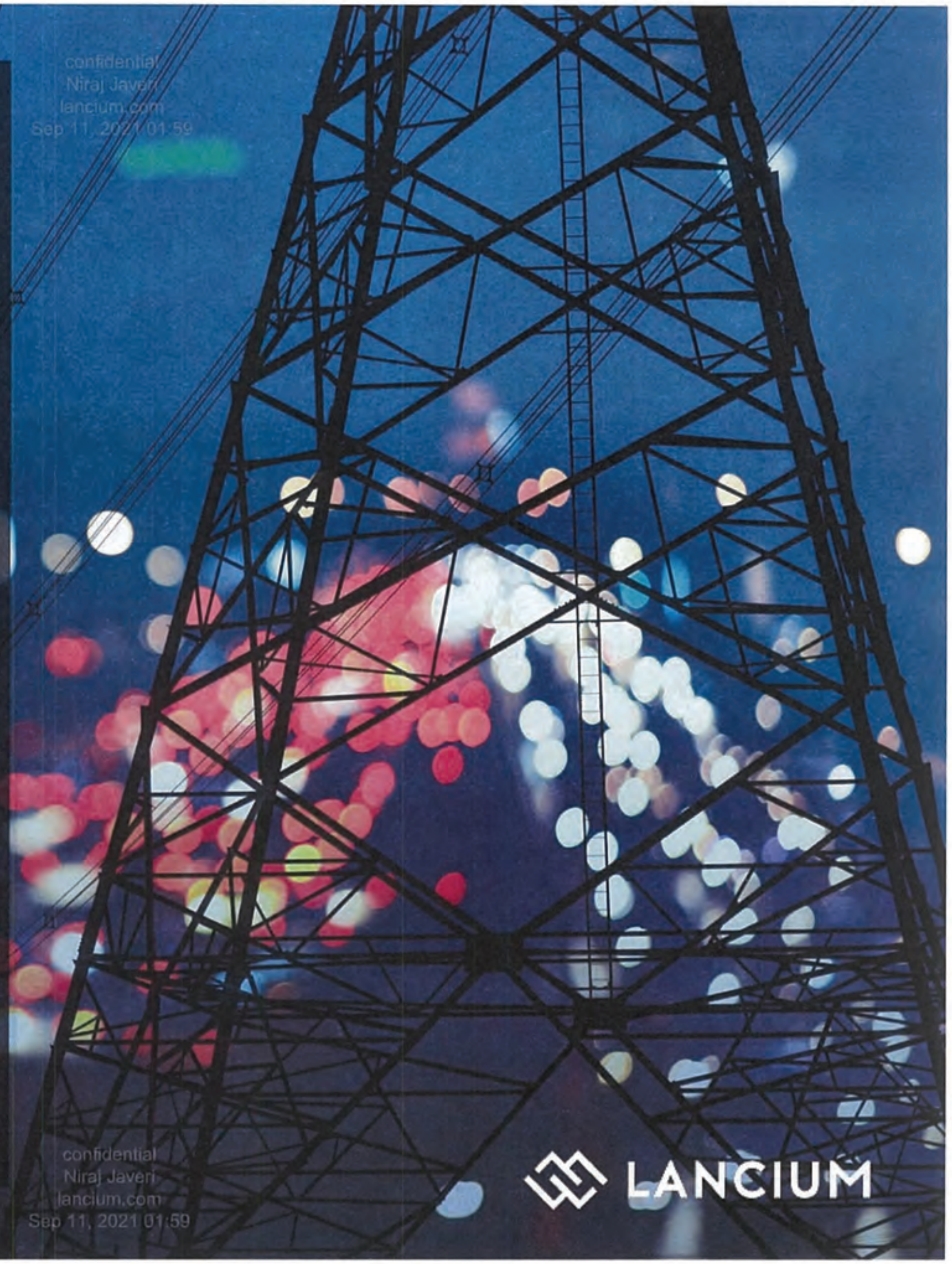
Kyte Crigger
Analyst
(415) 248-2299
kcrigger@btig.com

LANCIUM

Transaction Summary

Term	Description
Issuer:	Lancium Technologies Corp
Security:	Convertible Preferred Stock
Transaction Type:	Private Placement
Transaction Size:	Up to **$200 million** at Issuer Discretion
Primary/Secondary:	100% Primary
Use of Proceeds:	▪ Development of first two Lancium campuses for cryptocurrency mining and other energy intensive applications across Texas ▪ Working Capital ▪ General Corporate Purposes
Ranking:	**Senior to Common Stock**
Placement Agent	BTIG
Target Closing Date:	Q2 2021

Table of Contents



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SECTION 1.0
EXECUTIVE SUMMARY
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LANCIUM

Executive Summary

- **Lancium, LLC** ("Lancium" or the "Company") is developing infrastructure and software providing the world's lowest cost, largest scale, green power for uses such as cryptocurrency mining
  - Diversification of revenue via merchant and hosted Bitcoin mining, software licensing, monetizing energy/ancillary services, and hosting other energy intensive customers
  - 18 employees today in various functions across the business
- Lancium software enabled the **world's first Controllable Load Resource ("CLR")** data center in 2020
- Lancium campuses have proprietary access to the largest pool of ultra low-cost power specifically well suited for Bitcoin mining and will monetize this via long term recurring revenue arrangements with customers
- Led by a highly experienced management team with backgrounds in digital assets, data center technology, energy, and finance
- The Company is now **seeking a capital partner to invest in its next stage of growth**
- Proceeds will fund an ambitious growth strategy that aims to install over 2 GW of capacity by mid-2024

Enormous Total Addressable Market

Proof of Work Mining	Distributed Computing	Hydrogen, DAC, Green Fuels
$40B by 2024	$733B by 2027	$2T by 2050[1]

Key Competitive Advantages		Targeted Scale	
~1.5¢ / kWh Power Prices	**15** Patents Granted or Allowed	**2,000 MW** Installed Power	**80 EH/s** Hashrate Hosted
$3,000 BTC Breakeven[2]	**40+** Patents Pending	**#1** North American Mining Power[3]	**~8%** of BTC Hashrate[4]
Largest Development Portfolio	**100%** CLR Market Share	**Negative** CO2 Intensity	**$260+million** 2025 EBITDA

Selected Partners

RIOT Blockchain, Whinstone, ENIGMA, Tenaska, SBI Holdings, Shell, MP Energy

World's First Controllable Load Resource	**~285%** 2020E-2024E Revenue CAGR	**75%+** Run rate EBITDA Margins

BTIG

Notes:
(1) Source: Goldman Sachs.
(2) Assumptions: New generation Bitcoin mining ASICs, direct operating costs and difficulty levels as of 5/7/21.
(3) Based on currently identified pipeline of facilities and publicly announced growth plans of listed companies.
(4) Based on projected growth in hashrate for Company vs. projected growth in hashrate for industry by end of 2025.

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LANCIUM

Digital Asset Mining Landscape

Overview of selected mining comparables

	Bitfarms	Cipher Mining	Greenidge Generation	HIVE	HUT 8	Marathon	Riot Blockchain	Lancium
Locations	CAN	U.S. (TX, OH)	U.S. (NY)	CAN, Sweden, Iceland	CAN	U.S. (MT, ND)	U.S. (NY)	U.S. (TX)
CO2 Intensity	Low	Medium	High	Low	Medium	Very High	Medium	**Negative**
Power Cost (cents per kWh)	4.0	2.7	2.2	4.0	4.5	2.8	N/A	**1.5**
Enterprise Value ($MM)	$931	$2,000[1]	$1,100[2]	$1,217	$628	$2,954	$2,585	**N/A**
Capacity (MW) Q4 2021	69	0	~85	~52	104	105	75 (Excluding Whinstone)	**55**
Capacity (MW) Projected	269 by Q4 2022	~745 by 2025	~500 Potential	~120 Potential	N/A	~500 Potential	750 (Including Whinstone)	**2,000+**
EV / Capacity Current ($MM/MW)	13.5x	N/A	12.9x	23.4x	6.0x	28.1x	34.0x	**N/A**
EV / Capacity Projected ($MM/MW)	3.4x	2.7x	2.2x	10.1x	N/A	5.9x	3.4x	**N/A**

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Source: Capital IQ as of 5/7/2021.
Note(s):
(1) Based on an announcement of combination with GWAC special purpose acquisition company; (2) Based on agreed-upon valuation between Support.com and Greenidge Generation Holdings as described in merger announcement; (3) Based on projections for 2023E.

LANCIUM

Lancium Business Model

Revenue model flexibility combined with low energy costs

Development and Revenue Model

- Lancium will fund campus development, including electrical infrastructure, and manage power delivery to customers
- Bitcoin miner customers will fund data center capex and enter into a long-term tenancy and electricity purchase agreement with Lancium
- Lancium will charge a mix of flat fee plus a Net Profit Interest ("NPI") in the Bitcoin mining operation
- Target 2025 EBITDA: $260mm (equivalent of ~14EX/s net to Lancium)

Advantages for customers:

- Lowest fixed cost and NPI in the industry
- Alignment of interest and downside protection

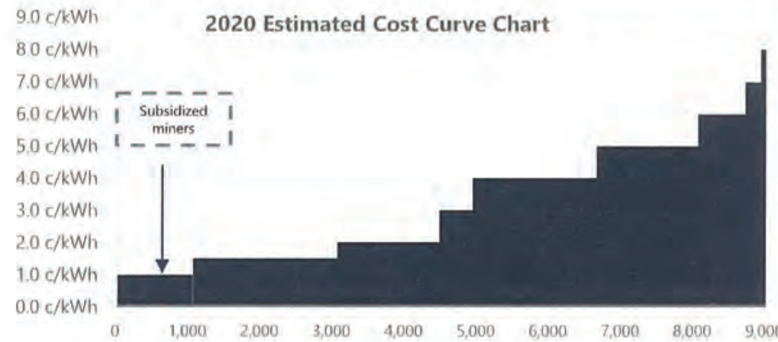
Advantages for Lancium:

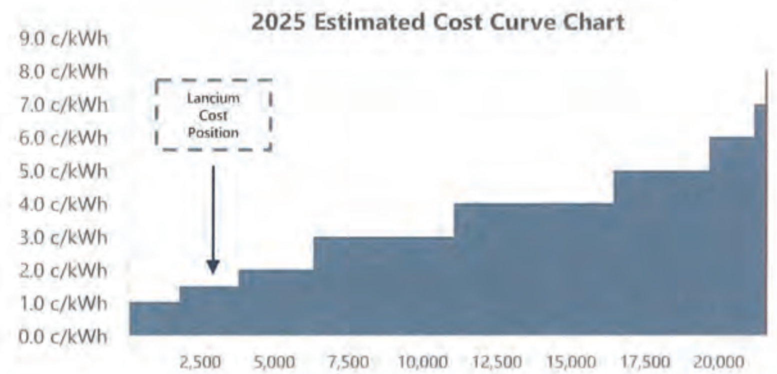
- Fixed return plus Bitcoin upside without the ASIC Capex

Why Lancium Sites:

- Bitcoin miners have exhausted available excess hydro resources globally
- Current bottom tier costs achieved via subsidies or captive power
- Lancium hosting terms are less expensive than building own sites for vast majority of Bitcoin miners

Bitcoin Mining Cost Curve Chart (MW)[1]





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Source:
(1) BitOoda & Lancium internal estimates.

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TX125.0009


SECTION 2.0
INVESTMENT HIGHLIGHTS
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LANCIUM

Investment Highlights

LANCIUM

1 Driving Clean Energy Adoption

- Lancium has some of the best development sites in the world – located in North and West Texas which is abundant in low-cost renewable energy and boasts some of the best wind and solar quality in the US
- Lancium Campuses help accelerate the global energy transition while 1) reducing the costs of renewable energy; 2) resolving intermittency and congestion issues and 3) providing critical ancillary services that wind and solar cannot

2 2GW Capacity / ~1.5¢/kWh

- Reliable low-cost power sources are not easy to find especially at very large scale
- Over 2GWs of Lancium Campus capacity is strategically located near congested grid points in Texas where renewables are abundant, energy is cheap and transmission capacity is finite
- Smart Response™ software unlocks ancillary service revenues not available to other miners

3 Smart Response™ Software – Best-in-Class Intellectual Property

- Covered by five US patents, allows data centers to ramp power consumption up or down in as little as five seconds giving Smart Response™ users a huge advantage to reduce power costs by 40-75% via buying power only when economic while simultaneously selling and providing high valued grid reliability products
- Market leader with long term, recurring license revenue from several large-scale Bitcoin miners

4 Commodity Optimization Desk

- Major power companies use trading desks to optimize generation assets, Lancium is building the same function to optimize data centers
- Lancium can uniquely maximize margins in dynamic market conditions by securing and optimizing high value bitcoin mining products such as power, ancillary services, hashing, difficulty and bitcoin

5 Diversified Business Mix

- Lancium's business model is to enter into long term, fixed margin or profit-sharing arrangements that allow the Company to monetize its technology-enabled power price advantage
- Lancium is evaluating utilizing its scale and low-cost power advantage to enter new industries such as distributed computing, hydrogen and green fuels

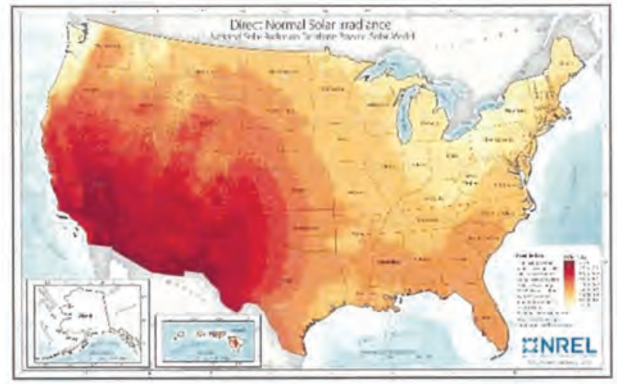
6 Highly Experienced & Motivated Management Team

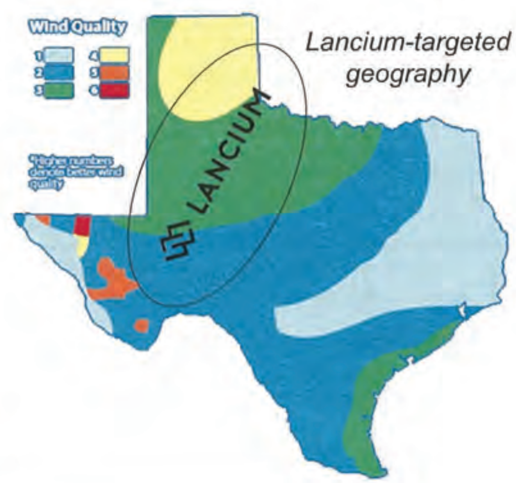
- Management team with a proven track record and diverse experience across data centers, energy, IT, technology, project finance and private equity

LANCIUM

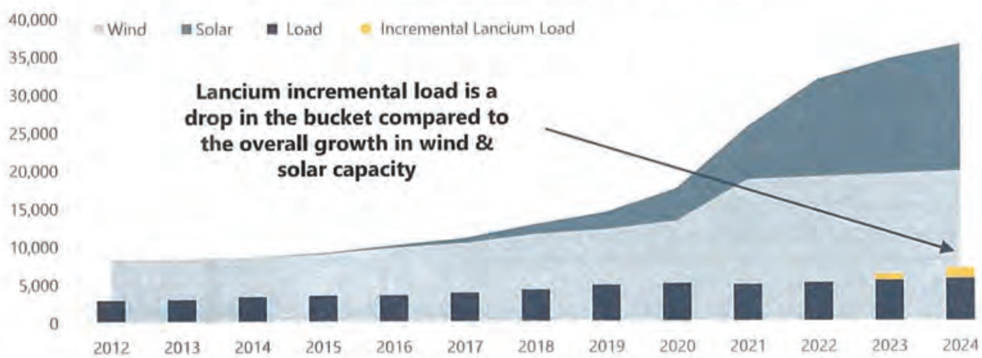
1 Harnessing Renewable Resource Power Generation

- Beyond the environmental benefits vs. fossil fuel generation, **solar and wind power offers several crucial advantages** to the Company:
  1) Lancium has some of the best development sites in the world – located in North and West Texas which is abundant in low-cost renewable energy
     - The area boasts some of the best wind and sun quality in the country, with low population density keeping site costs low
     - Grid connected Solar and Wind is growing exponentially faster than Load
  2) Solar and wind plants are more geographically diverse relative to traditional coal and natural gas-powered plants
  3) In Texas, solar costs are declining quickly - key solar metrics like Levelized Cost of Energy (LCOE) and Capex/W-AC are the best in the US





West Texas – Load vs. Wind & Solar Growth



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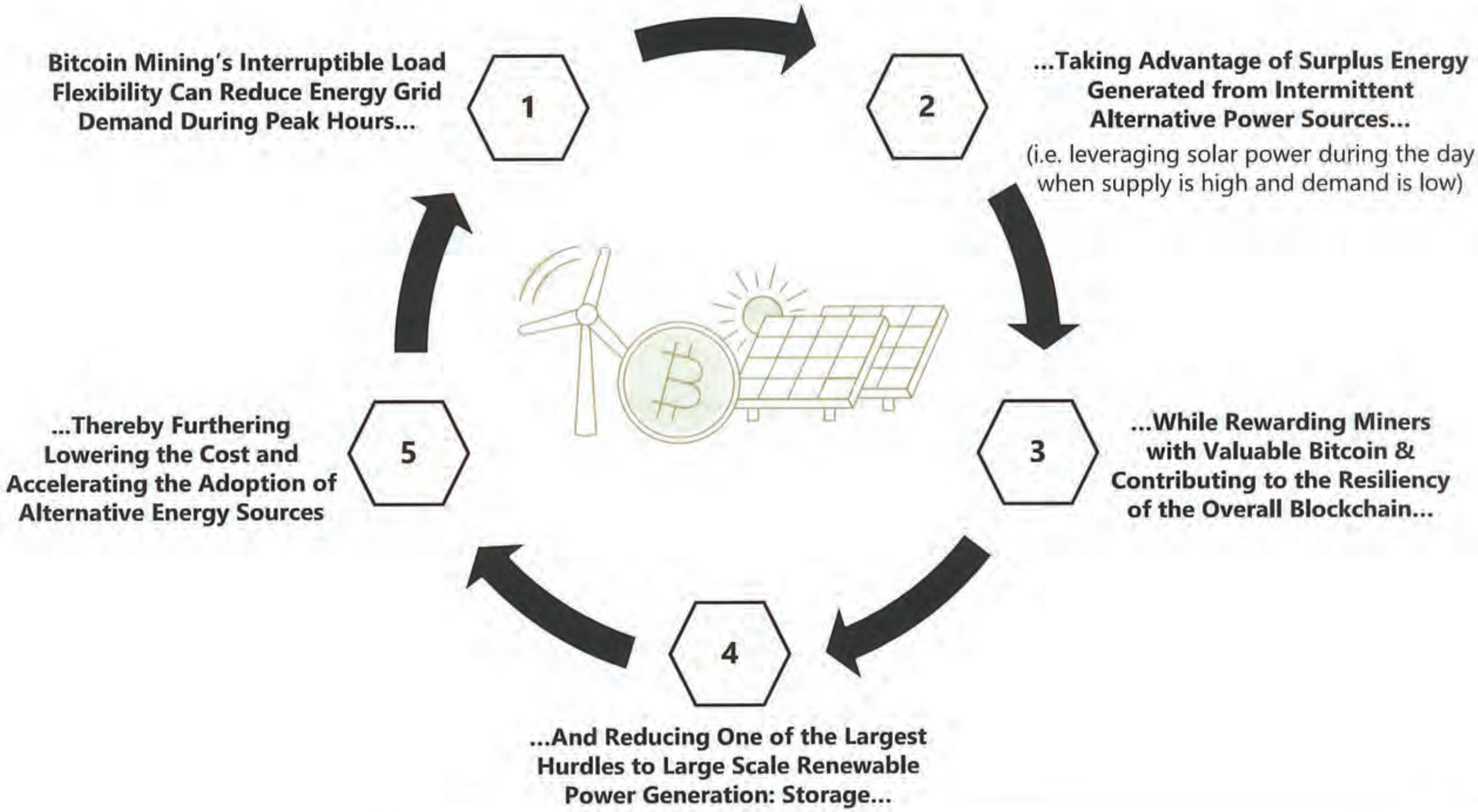
1 Bitcoin Mining Driving Clean Energy Adoption



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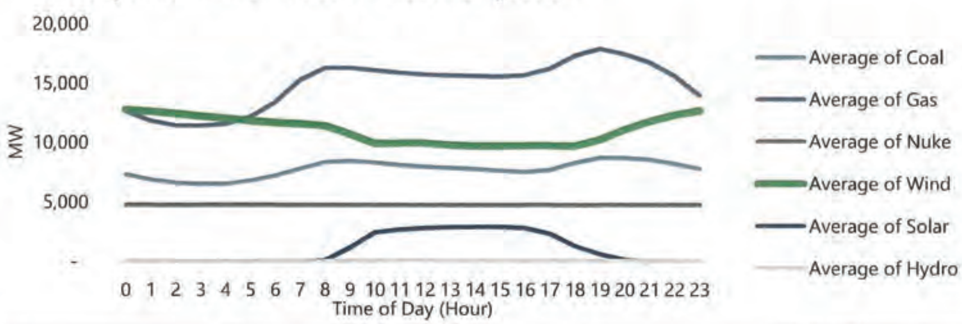
2 Capitalizing on Lowest-Cost Power Available Today

Power Congestion in Texas

- New renewable generation in North and West Texas is now overwhelming the transmission system for moving renewable energy to large load centers
  - Texas wind and solar will not be able to grow without another substantial investment in transmission infrastructure or the construction of large Controllable Load Resources close to renewable generation
- The (Competitive Renewable Energy Zones) CREZ lines were built in 2013 to facilitate the movement of renewable energy from West Texas to large load centers like Houston and Dallas
  - These lines are full resulting in congestion and low (even negative) cost energy in West Texas as power stations struggle to efficiently transfer all of their power Eastward during peak load

Hourly Energy Output by Fuel Type[1]

- In Texas, wind generation (green line) is 20% higher during the nighttime versus the daytime – which leads to more congestion



Lancium builds their campuses next to transmission limited renewable power sources to capture low-cost energy, but in turn serves as a market participant fueling broader wind/solar adoption and providing stability to the Texas energy grid

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Source:
(1) ERCOT.

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2 Significant Grid Arbitrage Opportunity

Falling Energy Prices[1]

- In the US, the Levelized Cost of Energy (LCOE) for solar and wind has fallen 90% and 71%[2] respectively, over the last ten years, driving the costs to $0.02-$0.05 / kWh vs. average fossil fuels costs around $0.05-$0.07 / kWh
- More specifically, in 2019, ERCOT experienced the lowest average LCOE in $/MWh in the US relative to other major geographies ($28.3 / MWh)
- ERCOT has also had one of the most consistent and rapidly decreasing LCOE regions in the US
  - $200.2 / MWh in 2012 to $28.30 / MWh in 2019

LCOE 2019

Capacity-weighted average levelized cost of electricity (LCOE) by year of operation, in 2019 $/MWh, at least 3 data points. Does not include effect of federal investment tax credit (ITC).

(Capex/W-AC) Price Trends by Region

- In addition, ERCOT has achieved incremental LCOE improvement while requiring less capital investment
  - For past three years, LCOE Capex/W-AC has dropped by ~25% per year
- In 2019, ERCOT had one of the lowest Capex/W-AC in country ($1.2 in ERCOT vs. $2.90 in ISONE)

Bottom Line: Lancium can take advantage of grid electricity arbitrage to mine bitcoin profitably as low as $3,000 per BTC

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Source:
(1) Berkeley Lab, Utility-Scale Solar 2020 Data Update. https://emp.lbl.gov/capex-lcoe-and-ppa-prices-region
(2) Lazard, Levelized Cost of Energy and Levelized Cost of Storage – 2020 https://www.lazard.com/perspective/lcoe2020?utm_source=newsletter&utm_medium=email&utm_campaign=newsletter_axiosgenerate&stream=top

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⟨2⟩ Lancium Campus Developments

Wholly-owned subsidiary developing campuses in locations of excess solar & wind generation

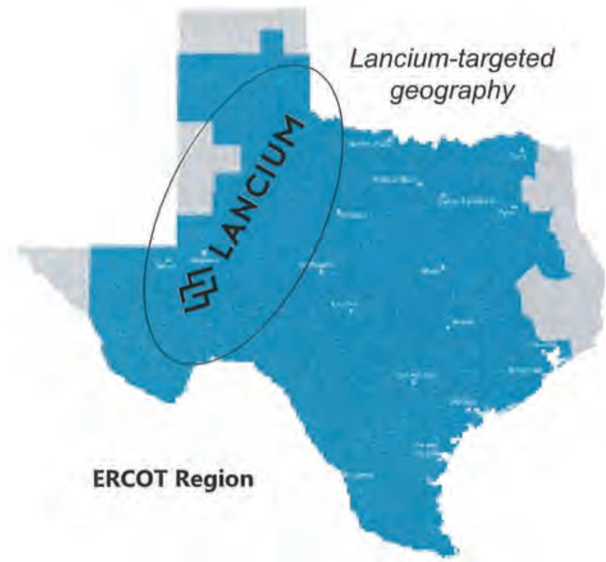
Site Locations

- Lancium has originated large campuses ("*Lancium Campuses*") in Texas ideal for Bitcoin mining and other energy-intensive industries
- Lancium development team spent nearly a year searching over 20 million acres in Texas for viable sites
  - The team has identified 8 total sites that meet all criteria with 5 identified as the most promising with combined footprint of ~2,000 acres (~0.01% of searched area)
- Lancium has purchased several sites, all of which are at various interconnection stages with the local transmission providers

Search Area: 20 Million Acres
Load zone, service territory, power availability, & proximity to renewables

Viable: 500k Acres
Location, availability infrastructure, & labor

8
Identified Sites



Lancium's efforts have resulted in a +2GW development pipeline and they will continue to originate and develop facilities to ensure that the Company has access to the most attractive opportunities

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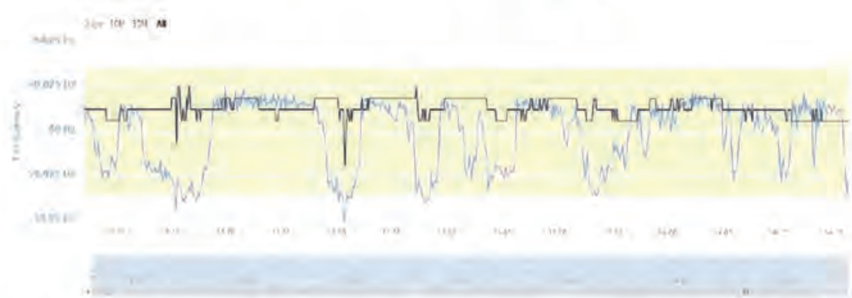
3 Smart Response™ & Controllable Load Resource (CLR)

- Lancium's Smart Response™ software, covered by five US patents, allows data centers to ramp their power consumption up or down in as little as five seconds
  - As data center power demand continues to escalate, Smart Response™ **can unlock huge power costs savings for data center owners**
- **Smart Response™ software enabled the world's first load-only Controllable Load Resource in 2020**
  - The Controllable Load designation existed in ERCOT since 2013, but Lancium innovations allowed it to finally become a reality
  - Controllable Loads have the unique ability to interact with the wholesale power market exactly like a generator
- Lancium Smart Response™ software is functional today on Bitcoin mining ASICs with traditional servers coming next



1 **Smart Response™**

+

2 **Lancium's Campuses**

Low-Cost Energy	Price Volatility	High-Priced A/S Market

+

3 **Power Management**

Ancillary Service Revenue	Economic Price Dispatch

=

4 **Lowest All-in Energy Cost**

Originally developed to match Bitcoin Mining power consumption with the variable power generation from wind farms, Smart Response™ today plays a much larger role on the grid by promoting grid stability and resiliency

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3 Controllable Load Resource vs. Demand Response

	Value	CLR	Demand Response
Overview	*Value proposition for providing the service*	*Industrial loads with sophisticated control systems and ramping capability*	*Under Frequency Relay 611 NCLRs with 7,000 MWs of total registered capacity*
Energy Bidding ISO Dispatch (SCED)	$$	●	○
A/S Service Regulation Up	$$	●	○
A/S Service Regulation Down	$	●	○
A/S Service Responsive Reserve Service	$$$	●	◔
A/S Service Non-Spinning Reserves	$	●	○

The Lancium CLR solution allows for participation in energy binding and the full range of ancillary services within the ERCOT system, maximizing extracted value and thereby driving effective power prices lower

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3 Best-in-Class, Defended Intellectual Property

- Since Lancium began developing power ramping technologies in 2017, the Company has amassed an extensive patent portfolio that protects their core innovations, most notably Controllable Load Resource (CLR)
  - Lancium has seven (7) granted and (8) allowed US patents, have +40 pending patents with more filed every month
- On June 19, 2020, Lancium announced the first successful load-only Controllable Load Resource designation by ERCOT in a partnership with MP2 Energy (a subsidiary of Shell) cementing the Company as a pioneer and leader in load-only CLR
- **The defensibility of Lancium's IP portfolio has most recently been validated in lawsuit against Layer1 Technologies claiming patent infringement on US Patent 10,608,433**
  - On March 8, 2021, the suit was settled with Layer1 ultimately agreeing to license Smart Response™ from Lancium
  - The outcome was not only favorable for the Company, but presented a case for the growth potential of Lancium's software licensing revenue

As a result of Lancium's intellectually property leadership and high-quality patent portfolio, the Company effectively owns 100% of the load-only CLR market space

Patent No.	Granted	Title
10,873,211	12/21/2020	Systems and Methods for Dynamic Power Routing with Behind-the-Meter Energy Storage
10,452,127	10/22/2019	Redundant Flexible Datacenter Workload Scheduling
10,444,818	10/15/2019	Methods and Systems for Distributed Power Control of Flexible Datacenters
10,367,353	7/30/2019	Managing Queue Distribution between Critical Datacenter and Flexible Datacenter
10,618,427	4/14/2020	Behind-the-Meter Branch Loads for Electrical Vehicle Charging
10,857,899	12/7/2020	Behind-the-Meter Branch Loads for Electrical Vehicle Charging
10,608,433	3/31/2020	Methods and Systems for Adjusting Power Consumption Based on a Fixed-Duration Power Option Agreement

15 allowed patents with additional 40+ pending patents

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4 Commodity Optimization Desk

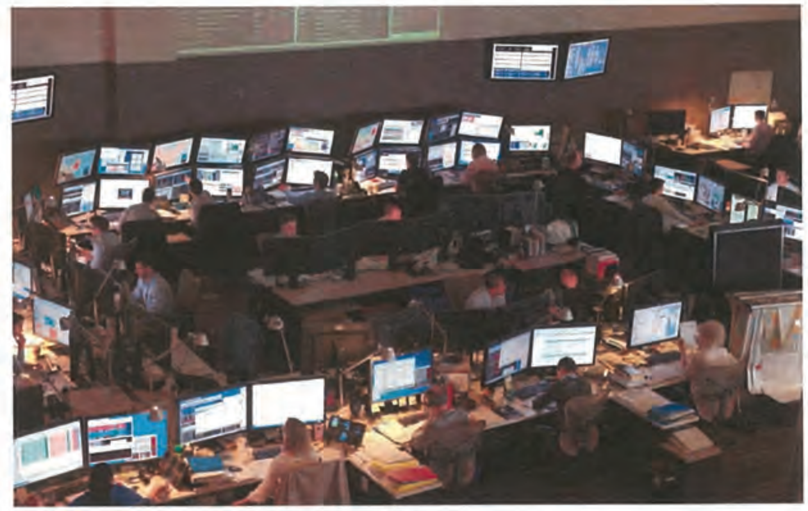
Bitcoin Mining, Power and Ancillary Services Optimization

Purpose

- Lancium's campuses will eventually consume approximately 17 TWh of power annually. The Commodity Optimization Desk can maximize margins trading and hedging the financial elements of the Bitcoin mining operation such as power, ancillary services, hashing, difficulty and bitcoin

Responsibilities

- Reduce all-in delivered energy cost by greater than 50% of energy supply cost
- Deliver revenue per Exa-Hash that is at least 97% of what would have been received if mining at 100% up-time
- Maximizing asset margins through knowledge and experience with market fundamentals
- Manage commodity exposures linked to the data campus Assets owned by Lancium or Lancium Customers
- Provide pricing and other analytical support services



- Power companies that own and operate a portfolio of Generation Assets representing >1GW of capacity have typically develop in-house "Trading & Marketing" competencies to maximize margins by securing and optimizing high valued products and markets - which can deliver 25%+ in additional earnings
- Lancium recognizes that there is very little difference in optimizing a portfolio of Generations Assets versus a portfolio of data campuses. **They both have commodity inputs and outputs**

In the long-term, mining will evolve to resemble the traditional commodities industry with Lancium in a compelling leadership position

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5 Diversified Business Mix With Room to Scale

Lancium can flexibly direct its capacity at the most profitable use case depending on market conditions

Cryptocurrency Mining	Distributed Computing	Long-Term Growth Areas
Hosted	Rendering	Hydrogen
Self-Mining	Simulation	Green Fuels
	AI / ML	Carbon Capture

Self-Mining Pros & Cons

Pros	Cons
✓ More directly benefit from upside in cryptocurrency prices	× More directly exposed to volatility in underlying crypto-assets
✓ Highest ROI today for additional investments in capacity	× More capital intensive
	× Supply / demand imbalance for mining hardware

All of these are made possible by the lowest cost power in the industry

Power Cost Comparisons

- Long term success of energy-intensive mining / computing – and ability to scale vs. competitors - depends heavily on cost-curve positioning
- **Reliable low-cost power sources are not easy to find especially at very large scale**
- Lancium has a pipeline of 2,000+ MW and expects to establish itself as the provider of choice for any applications that require for ultra low cost, green power for years to come

Average Electricity Cost for Bitcoin Miners Today (¢ / kWh)

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5 High Growth / High Margin Business with Recurring Revs

Financial Profile

- Robust revenue growth driven by rapid expansion of capacity with ability to increase software licensing and ancillary service revenue over time
- Best-in-class margins driven by operational efficiencies:
  - Electricity costs – flexibility of consumptions allows the company to take advantage of price volatility
  - CLR function adds incremental ancillary services revenue not available to other miners
  - Potential for grid rule change that would drive delivered electricity prices at Lancium Campuses even lower
  - Simple, modular data center construction with very limited componentry and no air-conditioning
    - Lowers upfront and maintenance capex, while reducing overall G&A, electrical/utilities, and depreciation expense over the lifetime of the assets
- Prudent expense management
  - Limited salesforce, marketing & advertising due to IP and patent portfolio advantages
  - Low acquisition and installation costs due to remote location and large real estate footprint driven by data center location close to the renewable sources in rural, unpopulated areas
  - Major SG&A is salary expense to attract and retain our best-in-class team

($ in millions)	2019A	2020A	2021E	2022E	2023E	2024E	2025E
Revenue							
Lancium Campuses	$0.0	$0.0	$0.0	$7.5	$103.1	$205.7	$300.4
Smart Response℠ Software & Power Mgmt	0.0	0.4	2.3	7.9	13.8	15.9	17.6
Merchant Bitcoin Mining	0.7	0.6	8.8	72.9	55.2	32.3	24.3
Other	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Revenue	**$0.8**	**$1.0**	**$11.2**	**$88.4**	**$172.0**	**$253.9**	**$342.3**
% Growth		*36.4%*	*966.3%*	*692.8%*	*94.6%*	*47.6%*	*34.8%*
Lancium Campuses	$0.0	$0.0	$0.0	$0.5	$9.0	$19.7	$29.2
Smart Response℠ Software & Power Mgmt	0.0	0.0	0.1	0.8	1.4	1.6	1.8
Merchant Bitcoin Mining	0.4	0.5	1.3	11.1	9.0	10.9	9.9
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COGS	**$0.4**	**$0.5**	**$1.4**	**$12.4**	**$19.3**	**$32.1**	**$40.8**
Gross Profit	**$0.3**	**$0.5**	**$9.7**	**$76.0**	**$152.7**	**$221.8**	**$301.5**
% Margin	*43.2%*	*52.2%*	*87.1%*	*85.9%*	*88.8%*	*87.3%*	*88.1%*
Payroll	$1.9	$2.3	$3.8	$13.8	$24.0	$30.0	$36.0
Legal and Consulting	1.1	1.4	1.6	2.5	3.0	3.0	3.0
Rent	0.4	0.5	0.7	0.8	0.8	0.8	0.8
Travel	0.3	0.1	0.3	0.5	0.5	0.5	0.5
General and Administrative	0.3	0.3	0.3	0.4	0.4	0.4	0.4
Advertising & Marketing	0.0	0.0	0.3	0.4	0.4	0.4	0.4
Supplies & Materials	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Insurance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating Expenses	**$4.3**	**$4.6**	**$7.1**	**$18.5**	**$29.2**	**$35.2**	**$41.2**
% of Revenue	*554.3%*	*444.1%*	*63.9%*	*20.9%*	*17.0%*	*13.8%*	*12.0%*
EBITDA	**($3.9)**	**($4.1)**	**$2.6**	**$57.5**	**$123.5**	**$186.6**	**$260.4**
% Margin	*NA*	*NA*	*23.3%*	*65.1%*	*71.8%*	*73.5%*	*76.1%*
EBIT	**($4.7)**	**($4.9)**	**($6.5)**	**$5.3**	**$64.0**	**$135.5**	**$219.0**
% Margin	*NA*	*NA*	*NA*	*6.0%*	*37.2%*	*53.4%*	*64.0%*

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6 Highly Experienced & Motivated Management and Board

Management Team

Michael McNamara, CFA | Chief Executive Officer and Co-Founder
- Michael is a private investor active in energy and technology. Previously, he co-founded ROR Capital, where he partnered with leading PE firms to restructure several multi-billion-dollar natural resource companies
- Michael spent 10 years on Wall Street at several multi-billion hedge funds focused on natural resources and event-driven investments as part of teams ultimately overseeing $1bn+ of investments in the space
- Michael graduating Magna Cum Laude from Georgetown University with degrees in Finance and Accounting and he began his career at PriceWaterhouseCoopers with roles in the consulting and accounting divisions

Raymond Cline, PhD | Chief Technology Officer
- 30+ year of experience at the interface of computing and energy including management roles at EDS, SAIC and CGI
- Serves as President/CEO of RWI Mining and Managing Director of ClineHair Commercial Endeavors, both with significant focus on blockchain and software investments
- Raymond earned his Bachelor of Science in Chemistry at Kent State University, and his PhD in Chemical Physics at the University of Illinois Urbana-Champaign

Shaun Connell, MBA | EVP, Power
- Shaun has more than 15 years of experience in North American Energy Markets and has held multiple senior management level positions at TransAlta Generation Company including Head Trader, Eastern Energy and Managing Director of Sales and Marketing
- He has built and led teams in Trading, Asset Optimization, Origination and graduated from the University of Calgary's Global Energy Executive MBA program

Andrew Grimshaw, PhD | Chief Software Architect
- Andrew is currently "on leave" as a tenured Computer Science Professor at the University of Virginia and was previously co-chief architect for the NSF-funded XSEDE (Extreme Science and Engineering Discovery Environment)
- Andrew earned his Bachelor of Science at UCSD and his PhD in Computer Science at the University of Illinois Urbana-Champaign

Advisors

Andrew A Chien, PhD

Andrew currently serves as a William Eckhardt Professor in Computer Science at the University of Chicago as well as the Director and Founder of CERES Center for Unstoppable Computing

Advisory Capacity for Lancium: High Performance Computing, Zero Carbon Cloud

Ramanan Krishnamoorti, PhD

Professor of Chemical & Biomolecular Engineering, Petroleum Engineering, and Chemistry; Chief Energy Officer at University of Houston

Advisory Capacity for Lancium: Hydrogen, Direct Air Capture, Green fuels

Ken Anderson, JD

Former utility regulator and Commissioner of the Public Utility Commission of Texas. Previously an attorney in private practice.

Advisory Capacity for Lancium: ERCOT regulatory and electricity market design


SECTION 3.0
COMPANY OVERVIEW
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Company History

Lancium has built a robust pipeline of demand, and is now at an inflection point focused on expanding capacity

Company Founding and Beginnings

2017 – 2018

October 2017
- Company founded - began work on power ramping technology

July 2018
- Announces strategic debt and equity investment from SBI Holdings (Tokyo Stock Exchange: 8473)
- Lancium R&D test facility begins ramping testing on 1.5MW of ASICs

September-October 2018
- Files critical patent applications for US: 10,873,211; 10,444,818; and 10,367,353

CLR and Mining Exploration

2019 – 2020

June 2020
- Lancium and MP2 Energy achieve Controllable Load Resource designation at the Compute North data center in Big Spring, Texas

July 2020
- Whinstone becomes anchor customer for Smart Response™ and minority investment from Northern Data AG

August 2020
- Brings patent infringement suit against Layer1

December 2020
- Lancium partners with Riot Blockchain and Enigma to develop 8 MW pilot project combining next-gen immersion tech with Smart Response™

Expansion

2021 -

March 2021
- Lancium and Layer1 settle patent infringement lawsuit in favor of Lancium

2021-Onward
- Continue R&D partnership with Riot and Enigma
- Break ground on first two Lancium Campuses
- Sign 5th Software license agreement for Smart Response™
- Purchase up to 50 MW of power availability for merchant Bitcoin mining by mid-2022
- Continue build out of +2 GW clean computing centers across West Texas with generation coming online in October 2022

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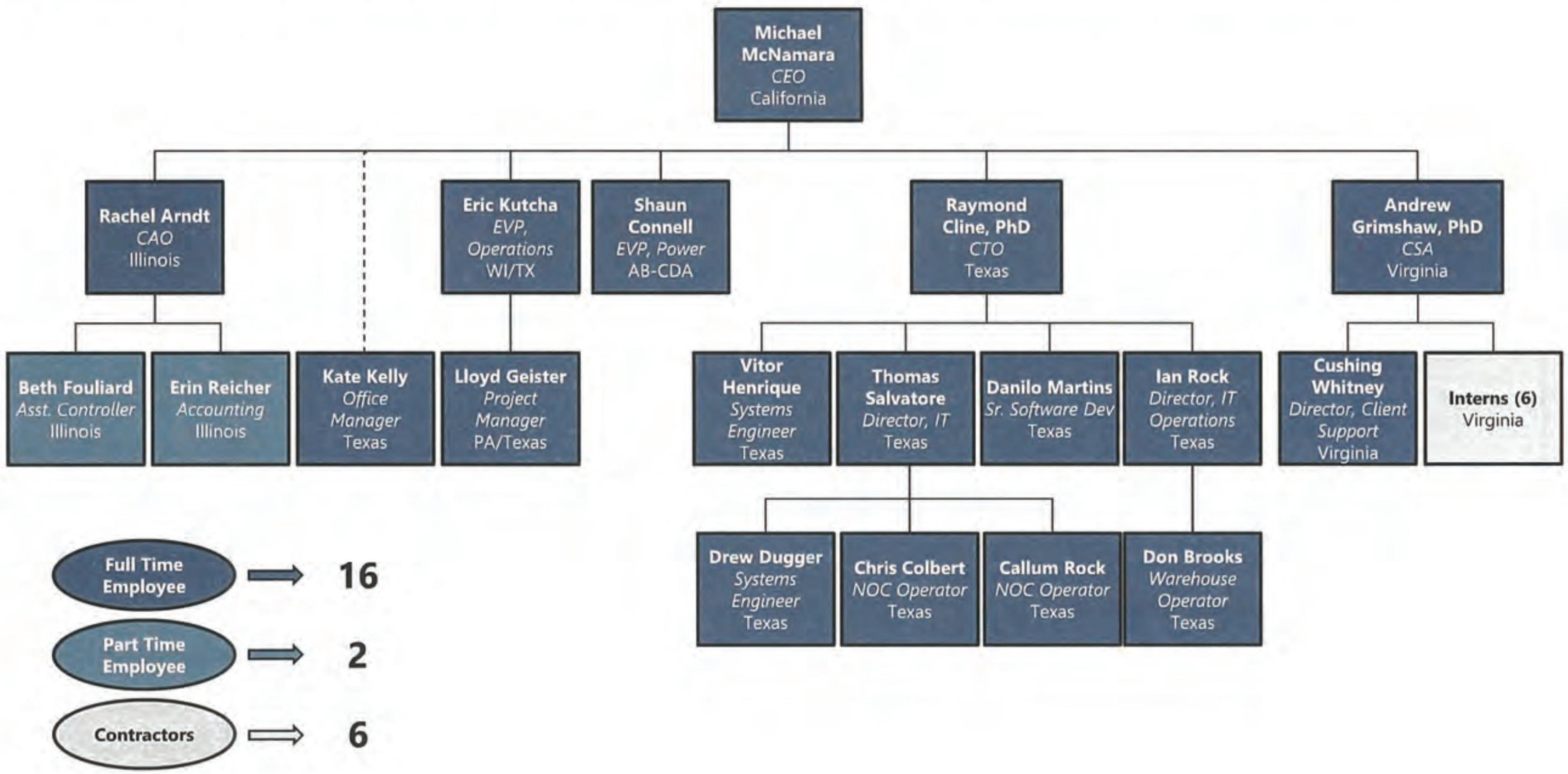
Organization Chart

Experienced team of technologists with experience across digital assets, software, energy and finance



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SECTION 4.0
PRODUCTS AND SERVICES
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Hybrid Business Model

Captures broad spectrum of value chain to maximize value extracted while diversifying revenue streams

MERCHANT BITCOIN MINING

Expanding merchant Bitcoin mining capacity to 27.5MW by YE 2021 with potential to expand to 50MW in Q1 2022

HOSTING

First Lancium Campus energized in 2022 (200MW) with additional 1,600+ MW in development

500+ MW hosting customers actively in discussions today

DISTRIBUTED COMPUTING

Lancium Compute is an emerging cloud service for interruptible, high throughput computing applications

SOFTWARE REVENUE

Lancium Smart Response™ has contracted long term, recurring license revenue from existing large scale Bitcoin miners

ENERGY AND ANCILLARY SERVICES

As a CLR, Lancium data centers can offer both energy and ancillary services to the grid like a Generator

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Green Computing at a Fraction of the Cost

- Lancium Campuses support the growth of renewable energy by bringing incremental but flexible demand directly to the most ideal locations that offer abundant or even curtailed green power
- Lancium's **Smart Response™** software allows data centers to adjust server electricity consumption rapidly based on power grid conditions such as price, frequency, and load
- Lancium will originate, develop and energize campuses with high and medium voltage equipment at very large scale for use by the enterprise customers initially for Bitcoin mining
- Lancium's business model is to enter long term (5+) year, fixed margin plus profit-sharing arrangements that allow the Company to monetize its technology enabled power price advantage

Lancium data centers are located at congestion points on the high voltage transmission system – allowing Lancium to capture large amounts of otherwise curtailable renewable energy

Numerous additional growth areas :

Distributed Computing $733B by 2027	Hydrogen, Green Fuels, DAC $2T by 2050

Lancium's Campuses enabled with Smart Response™ help accelerate the global energy transition while 1) reducing the costs of renewable energy; 2) resolving intermittency and congestion issues; and 3) providing critical ancillary services that wind and solar cannot

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Overview of Products and Services

Diversified mix of revenue streams from self-mining, hosting

Products and Services

1. **Bitcoin Mining**
   – Includes both self-mining and hosting revenue
   – Hosting revenue either done via fixed, "pass through" margin or via a Net Profit interest directly in the Bitcoin mining operation

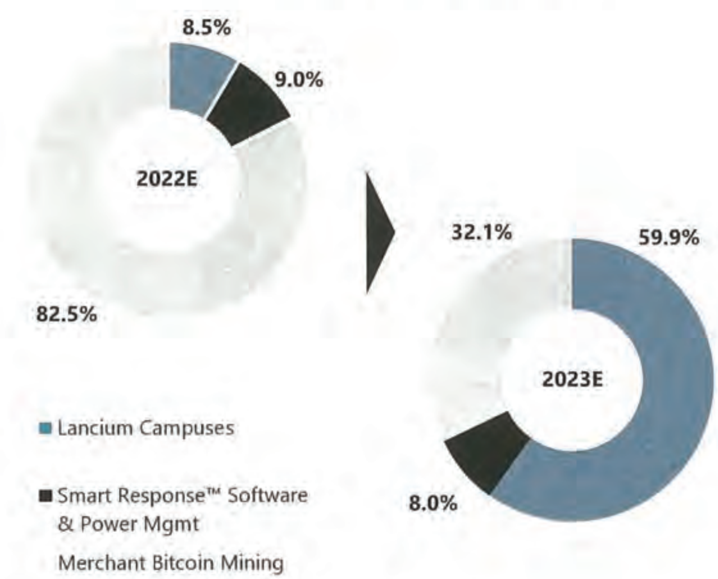
2. **Smart Response™ Software**
   – Long term, recurring licensing revenue generates incremental high margin revenue and creates more efficient energy grids around the world

3. **Distributed Computing**
   – Lancium Compute is an emerging cloud provider for low cost, high throughput applications

4. **Energy and Ancillary Services**
   – As a CLR, Lancium data centers can offer both energy and ancillary services to the grid, like a Generator, providing opportunities to monetize energy and ancillary services positions

Revenue Mix

- As Lancium Campuses are built out and come online, Campus revenues (including hosted bitcoin mining activities) increases from 8.5% to 59.9% of total revenue in 2022E to 2023E, respectively



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Lancium Campuses – Optionality

Self-Mining vs. Hosted Operations

Self-Mining vs. Hosted Operations - Overview

- Once Lancium Campuses come online, the Company will have the ultimate power to decide what space is dedicated to self-mining vs. hosted operations
- Given the size of Campuses development pipeline, the Company has good flexibility to speed or slow development based on customer demand
  - This flexibility allows Lancium to capitalize on current energy cost and Bitcoin spot prices to enhance overall profitability

Self-Mining
Combining Lancium's Smart Response™ with low energy and operating costs for internally-generated profit

Hosting
Providing infrastructure and ultra low-cost power and other services to outside miners

Revenue Model

- With self-mining prevailing BTC market and energy prices effectively determine mining profitability
- With hosting, Lancium can structure pricing contracts using a variety of attractive contract pricing, terms, and duration allowing the Company to opportunistically decide how, when, and what to charge
  - Examples of revenue models included fixed price vs. revenue sharing contracts
- Depending on the market, different contracts offer different value propositions to the company

Fixed Price Model
Lancium charges a set fee to customers, making the contracts more profitable when BTC prices are low

Revenue Share
Lancium charges a % on revenue generated by miners which benefits the company when BTC prices are high

Lancium's full suite of products and services can attract the largest miners – serving as a 'one-stop shop' for the industry's key participants – depending on energy and cryptocurrency market conditions, the Company can adjust the pace of growth across its various operations depending on supply/demand dynamics

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SECTION 5.0
GROWTH STRATEGY
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Facility Pipeline

Siting and power sourcing capability are key differentiators and value driver for its customers




Location	Taylor County, Texas	Childress County, Texas	Wheeler County, Texas	Kimble County, Texas
Description / Status	Lancium Campus 1 / Shovel-Ready	Lancium Campus 2 / Shovel-Ready	Lancium Campus 3 / In Planning	Lancium Campus 4 / In Planning
Target Date	October 2022	October 2022	January 2023	April 2023
Installed Capacity	200 MW (Phase 1) +500 MW (Phase 2)	300 MW	500 MW	500 MW
Key Stats	• 875 Acres • Phase 1 interconnection agreement received	• 212 Acres • Interconnection request submitted	• 597 Acres • Interconnection planned at 345KV	• 667 Acres • Interconnection planned at 345kV

Additional sites have already been identified with the potential to increase capacity materially

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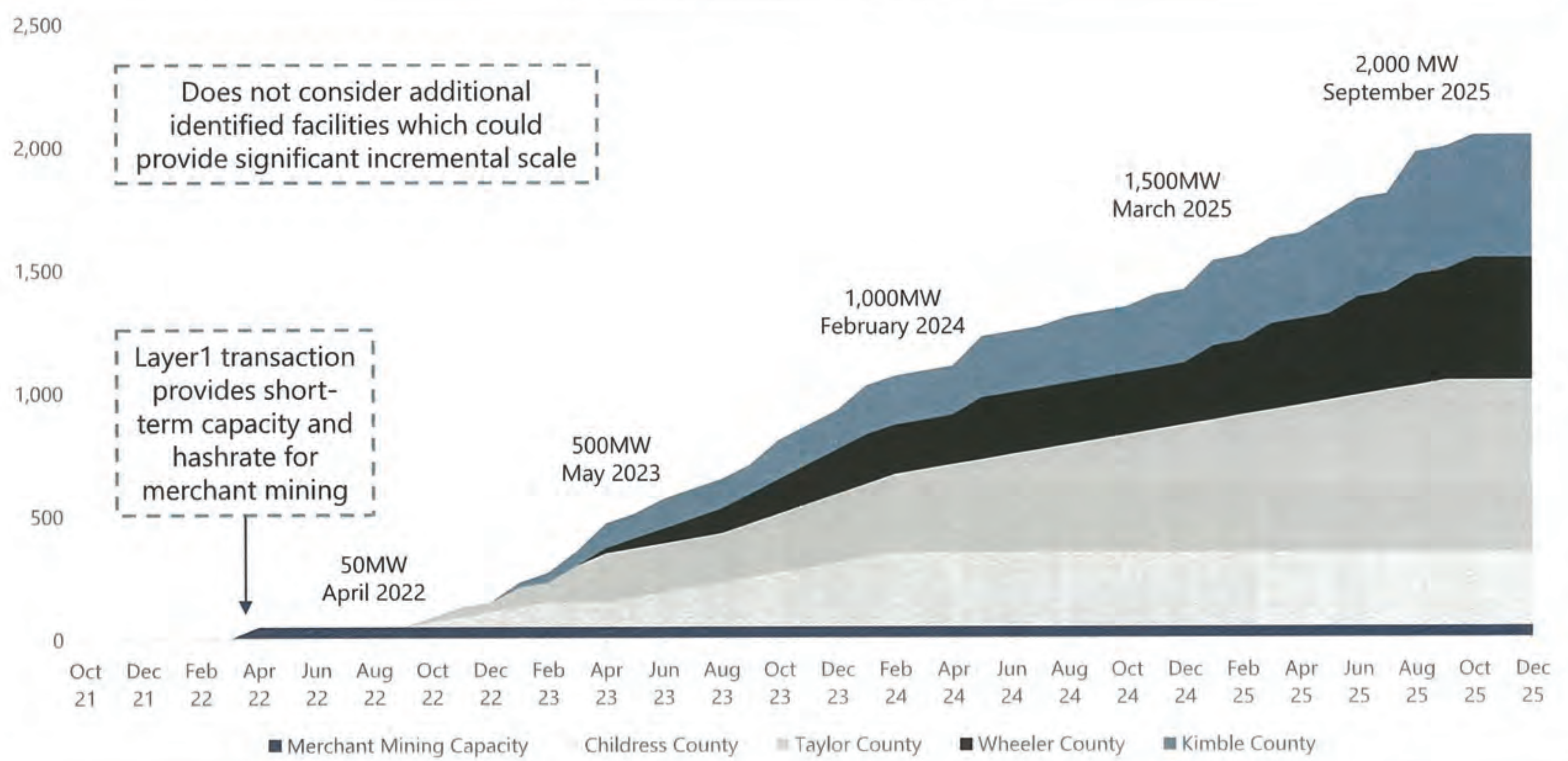
Accelerating Growth Through Capacity Ramp-Up

Forecasted capacity ramp from October 2022 to December 2025

Forecast Lancium Capacity Scale



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Bitcoin Mining, Energy and Ancillary Services Optimization

Based on 300MW Smart Response™ enabled data campus with $35 fixed price hedge, min/max load of 6/300MW

	Strategy	$ per Year	Description
TDSP	Transmission Cost Avoidance (4CP)	**$15.6M** ($6.00/MW)	Avoiding energy consumption during the four coincident peak (4CP) intervals between June and September that are used for allocating Transmission charges the following year.
A/S	Ancillary Services - Dynamic Pricing and Optimization	**$38.7M** ($15.00/MW)	Monitor ERCOT ancillary service products and prices and use an automated algorithm to maximize hourly ancillary service revenue.
ENERGY & BITCOIN HASH	Economic Turndowns – Hash or Cash **This strategy can be used hourly, Daily, Weekly or Monthly**	**$7.89M** ($3.00/MW)	Occurs when you can sell back your contracted power purchase for a higher price than the installed miner's computation breakeven Ex/MWh. **Example** - You own 100MWs of $35 fixed price power and next day ERCOT is trading at $200/MW. The Bitcoin Network value for hashing is $2.00/EH and you are running 100MWs of S9 miners with a hashing output of 36EH/MW –which implies a computational break-even point of $72 and gross margin of $37/MW ($72 - $35) The optimal decision is to sell back our $35 fixed price next day power for $200 (locking in $165/MW gain) and configure Smart Response™ to only consume next day hourly energy during intervals where spot energy price is lower than $72/MWh.
	Selling Out of the Money (OTM), Covered Call Options	**$2.7M** ($1.00/MW)	Monetizing the inherent option value of owning fixed price power in a market with seasonal and hourly volatility. **Example** – Next week power is trading $35. This implies we will mine 24/7 next week. We can capture extrinsic value to our fixed block hedge by selling next week $72 daily calls.
	Open Position Management - Dynamic Hedging	**$4.4M** ($20.00/MW) ****Based on 25MWs of Old Gen Capacity*****	Old Gen miners can be viewed as a super cheap out of the money (OTM) option on bitcoin price. This strategy monetizes the real option value of owning OTM bitcoin mining hardware. If/when bitcoin price surges up –sell forward expected bitcoin earnings knowing sales can be covered by turning on old gen mining equipment. If/when price goes down, we buy back our short position.

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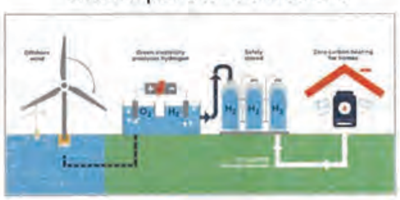
Additional Expansion Opportunities

With global emphasis on curbing climate change, Lancium is positioned to benefit from a host of green initiatives

Lancium's exceptionally low cost power will allow it to serve emerging growth markets…

1 Hydrogen Electrolysis

- Electrolysis is a promising option for hydrogen production from renewable resources
- Electrolysis is the process of using electricity to split water into hydrogen and oxygen
- Hydrogen production via electrolysis using renewable wind energy results in virtually zero greenhouse gas and criteria pollutant emissions



2 Green Fuels

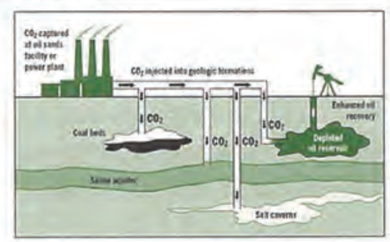
- Renewable hydrocarbon biofuels are produced from biomass sources through a variety of biological, thermal, and chemical processes
- These products are chemically identical to petroleum gasoline, diesel, or jet fuel and can be used in existing engines and infrastructure
- CO2 captured by growing feedstocks reduces overall greenhouse gas emissions by balancing CO2 released from burning renewable hydrocarbon biofuels compared with fossil fuel

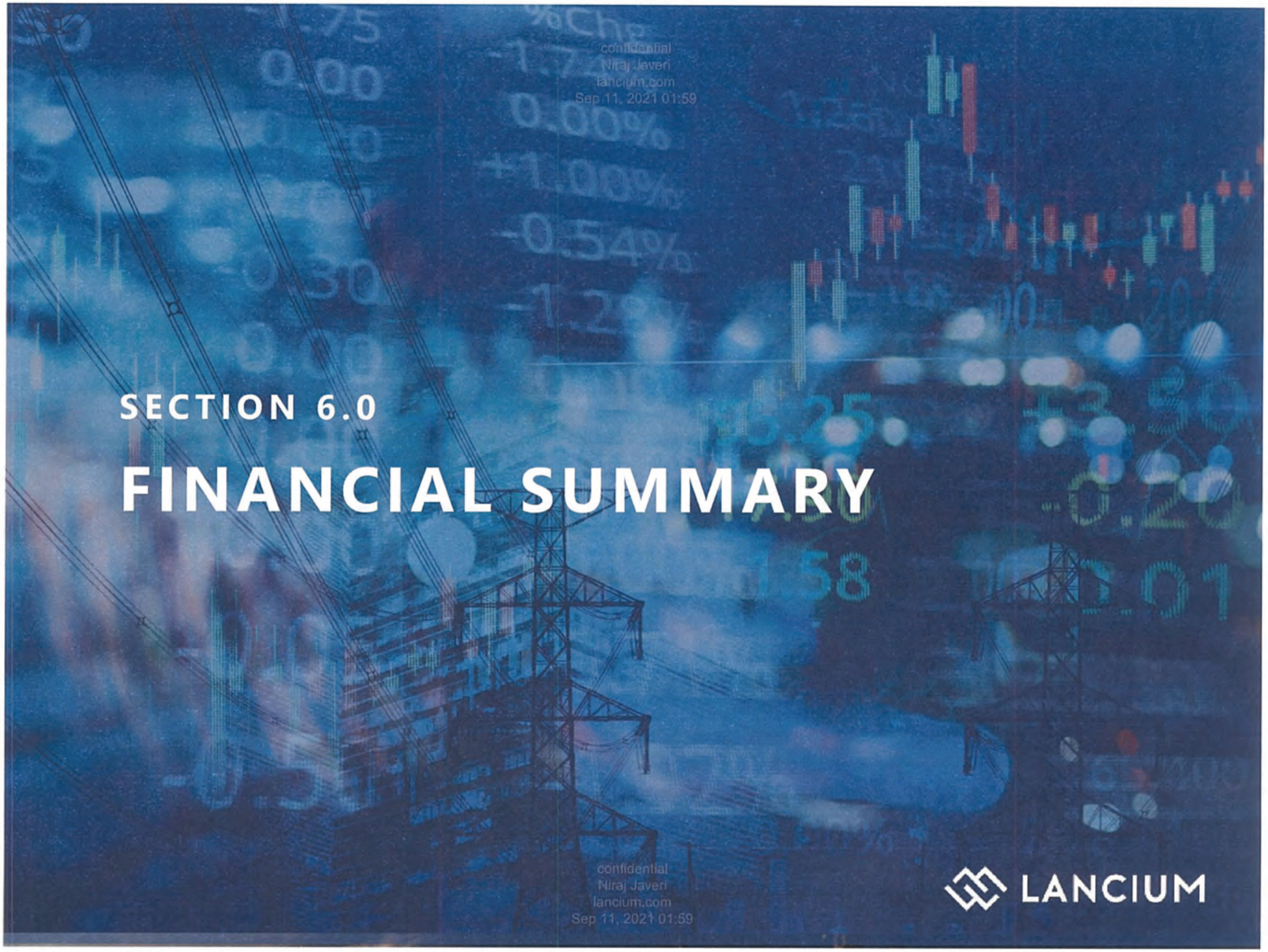
3 Green Metals

- The steel industry must eliminate 1.7Bt of direct Scope 1 and indirect Scope 2 emissions over the next 20 years – or face a cost of US$191 billion each year in carbon taxes
- Until recently, CO2 emissions associated with iron and steelmaking have been cheap, creating little incentives to shift to greener production
- Making the shift to renewable power will be one of the biggest factors in reducing the industry's carbon footprint

4 Carbon Capture

- Carbon capture and sequestration/storage (CCS) is the process of capturing carbon dioxide (CO_2) formed during power generation and industrial processes and storing it so that it is not emitted into the atmosphere
- CCS technologies have significant potential to reduce CO_2 emissions in energy systems
- Facilities with CCS can capture almost all of the CO_2 they produce (some currently capture 90% or even 100%)
- Lancium plans to couple all technology with Carbon Capture in the future





SECTION 6.0

FINANCIAL SUMMARY

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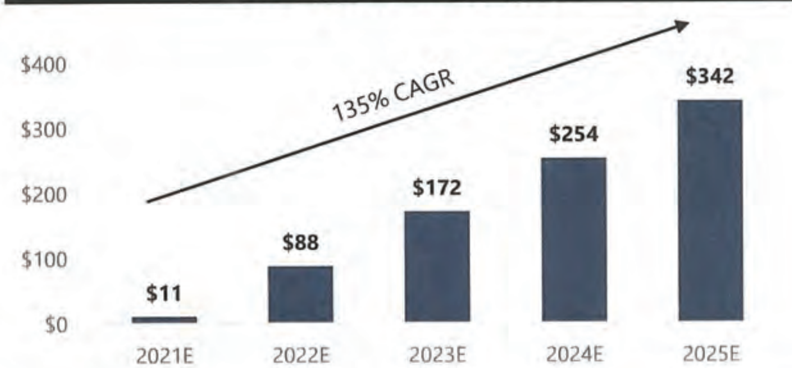
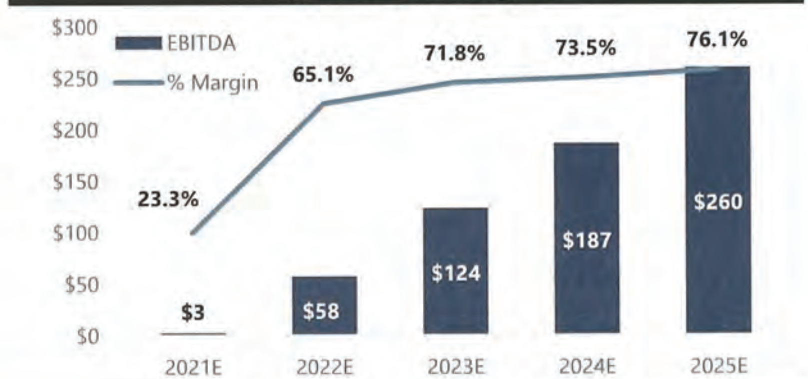
Financial Projections

Highly recurring revenue model drives a 5-year revenue CAGR of 135%

Strong Revenue Growth

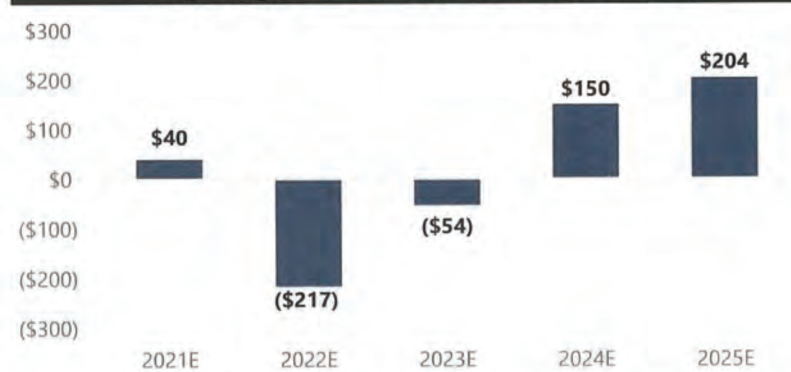


High EBITDA Margins



Capital Expenditures

Targeting Positive Annual Cash Balance



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Financial Overview & Commentary

Attractive financial profile driven by substantial near term revenue growth and improving margins

($ in millions)		Fiscal Year Ending December 31, 2020A	2021E	2022E	2023E	3-Year CAGR
Revenue						
Lancium Campuses		$0.0	$0.0	$7.5	$103.1	NA
Smart Response™ Software & Power Mngmt		0.4	2.3	7.9	13.8	217.3%
Merchant Bitcoin Mining		0.6	8.8	72.9	55.2	362.0%
Total Revenue	1	$1.0	$11.2	$88.4	$172.0	447.9%
% Growth		36.4%	966.3%	692.8%	94.6%	
Lancium Campuses		$0.0	$0.0	$0.5	$9.0	NA
Smart Response™ Software & Power Mngmt		0.0	0.1	0.8	1.4	217.3%
Merchant Bitcoin Mining		0.5	1.3	11.1	9.0	170.0%
COGS		$0.5	$1.4	$12.4	$19.3	238.1%
Gross Profit	2	$0.5	$9.7	$76.0	$152.7	553.9%
% Margin		52.2%	87.1%	85.9%	88.8%	
Payroll	4	$2.3	$3.8	$13.8	$24.0	119.3%
Legal and Consulting		1.4	1.6	2.5	3.0	29.8%
Rent	5	0.5	0.7	0.8	0.8	14.3%
Travel		0.1	0.3	0.5	0.5	86.2%
General and Administrative		0.3	0.3	0.4	0.4	18.0%
Advertising & Marketing		0.0	0.3	0.4	0.4	124.1%
Supplies & Materials		0.1	0.0	0.0	0.0	(7.8%)
Insurance		0.0	0.0	0.0	0.0	(5.4%)
Operating Expenses		$4.6	$7.1	$18.5	$29.2	84.5%
% of Revenue		444.1%	63.9%	20.9%	17.0%	
EBITDA	3	($4.1)	$2.6	$57.5	$123.5	NA
% Margin		NA	23.3%	65.1%	71.8%	

Commentary

1. Strong annual revenue growth driven by rapid capacity expansion
   - 448% 3-year revenue CAGR resulting from significant revenue growth in Lancium Campus and Smart Response™ sales
   - Recurring revenue model allows Lancium to quickly scale ARR within in a short time frame
   - Lancium Campuses comprise ~60% of 2023E total revenue

2. Lancium business model to monetize infrastructure via long term fee-based model resulting in very strong Gross and EBITDA margins

3. Attractive EBITDA margins driven by low operating expenditure – virtually no sales, marketing or advertising

   4. Payroll comprises largest portion of total OpEx as a result of curating a high-skilled team
   5. Low rent expense a function of business model locating data centers near renewable power sources and in rural areas with extremely low costs of living
   - EBITDA margins quickly scale and stabilize to ~72% once data centers are built and fully functional in year 3

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Bitcoin Mining Economics

Revenue

Lancium Hashrate / Network Hashrate X BTC Price X 6.25 BTC / Block X 52,560 Blocks / Year

Less

Costs

Electricity (variable costs) + Annual Fixed Costs

[shaded box] Lancium Controls / Influences [dashed box] Lancium Subject to Protocol / Market / Competitive Environment

A constant number of Bitcoins are found every 10 minutes, with the reward split evenly by all hashrate (a measure of computing power) on the network

- As Bitcoin price rises, the value of the reward in USD also rises
- As more miners join the network, each miner's share of the total reward declines
- Miners also earn revenue from transaction fees

USD mining revenue per unit of computing power is uncontrollable, but Lancium's world-class miner efficiency and power costs ensure that it will be profitable in virtually any market environment

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Bitcoin's Increasing Visibility Highlights ESG Concerns

Mining bitcoin in a green manner will take increasing prominence as critics work to stoke sustainability concerns

Increasing Prominence on Corporate Balance Sheets

MicroStrategy – The software developer currently has $5.0 billion worth of bitcoin on its balance sheet

PayPal – The electronic commerce company recently added the ability to buy and sell cryptocurrencies and established a relationship with Coinbase exchange

Square – An American financial services company, and developer of Cash App – quickly becoming one of the highest volume crypto exchanges in the US

Tesla – The worlds leading electric automobile manufacturer has added $2.4 billion worth of bitcoin to its balance sheet

Mass Mutual – One of the largest insurance companies in the world - recently added $2.3 billion dollars worth of bitcoin to its balance sheet

Galaxy Digital – As 'true believers' for years, Galaxy has put its money where its mouth is and holds $100s of millions worth of BTC and other crypto assets

Over the last year we have seen a wave of corporations adding Bitcoin to their balance sheets as an inflationary hedge against national currencies.

While the fundamentals behind bitcoin make it attractive to add to a corporate balance sheet, the energy source from which it is most likely produced could lead to hesitation.

Less than 40% of all Bitcoin currently in circulation is being actively traded - with corporate adoption we can that percentage stands to decrease even further.

Lancium provides corporations a way to add bitcoin to their balance sheets that was produced with zero carbon emissions.

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Green New Deal

- The Green New Deal, a proposed package of US legislation aimed at accelerating American society to 100% clean and renewable energy while ensuring a just transition for both workers and frontline communities, first gained traction in the early 2000s
- More recently in 2019, a reinvigorated version of the Green New Deal (House Resolution 109 and Senate Resolution 59) was brought forth by Rep. Ocasio-Cortez of New York and Sen. Ed Markey of Mass.
- The ambitious resolutions call for decisive action, and quickly, leveraging research from distinguished institutions including the Intergovernmental Panel on Climate Change (IPCC)
  - The IPCC's 2018 *Special Report on Global Warming of 1.5° C*[1] outlines potential societal and economic impacts of climate change, suggesting CO2 emissions will have to be virtually cut in half by 2030 to avoid irreversible environmental damage
- At the bedrock of the Green New Deal, the proposal suggests overhauling the America's national grid by converting to 100% renewable energy, reducing greenhouse gas emissions from human sources by 40% to 60% by 2030, and achieving net-zero carbon neutrality by 2050

The increasing awareness and bipartisan support for legislation focused on curbing climate change will serve as a tailwind for increasing solar and wind energy adoption in the US in both the short and long term

Main Goals the Green New Deal:

- ✓ 100 percent of national power generation from renewable sources
- ✓ Building a national, energy-efficient "smart" grid
- ✓ Upgrading residential and industrial buildings for comfort, safety, and energy efficiency
- ✓ Decarbonizing manufacturing, agricultural, and other industries
- ✓ Decarbonizing, repairing, and improving transportation and other infrastructure
- ✓ Funding massive investment in the drawdown and capture of greenhouse gases
- ✓ Making "green" technology, industry, expertise, products, and services a major export of the United States, with the aim of becoming the undisputed international leader in helping other countries transition to completely carbon neutral economies

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Source:
(1) Intergovernmental Panel on Climate Change. Special Report on Global Warming of 1.5 °C. 2018. https://www.ipcc.ch/sr15.

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Colocation and Data Center Industry Landscape

Overview of selected colocation and data center REIT comparables

		CoreSite	CyrusOne	Digital Realty	Equinix	Keppel DC REIT	QTS	Switch	世纪互联 www.21vianet.com
Operational Metrics	Description	Provides high-performance data center, cloud access and interconnection solutions	Specializes in design, construction and operation of high-performance data centers worldwide	Provides the full spectrum of data center, colocation and interconnection solutions	Provides colocation services across more than 200 data centers globally	Invests in income-producing real estate assets used primarily for data center purposes	Provides data center solutions across more than 7 million square feet of owned data center space	Provides colocation space and related services	Provides carrier and cloud-neutral internet data center services
	Locations	United States	United States, Europe	North & South America, Europe, Asia Pacific	North & South America, Europe, Asia Pacific	Europe, Asia Pacific	United States, Netherlands	United States	People's Republic of China
	Capacity	256 MW	874 MW	1,847 MW	1,350 MW	300 MW	315 MW	490 MW	200+ MW
Financial Metrics	Market Cap	$5,395M	$9,008M	$41,709M	$64,222M	$3,351M	$4,289M	$2,363M	$4,078M
	Enterprise Value	$7,323M	$12,483M	$58,332M	$76,541M	$4,109M	$6,759M	$3,724M	$5,101M
	LTM Revenue LTM EBITDA / EBITDA Margin	$606.8M $308.5 50.8%	$1,033.5M $504.3M 48.8%	$3,846.0M $1,916.1M 49.8%	$5,963.1M $2,509.1M 42.1%	$200.3M NA	$537.3M $235.5M 43.8%	$511.5M $239.7M 46.9%	$744.8M $168.9M 22.7%
	2021E Revenue EV/ 2021E Revenue	$648.7M 11.3x	$1,127.6M 11.1x	$4,320.6M 13.5x	$6,629.1M 11.6x	$218.9M 18.8x	$608.3M 11.1x	$549.6M 6.8x	$956.2M 5.3x
	2021E EBITDA EV/ 2021E EBITDA	$342.9M 21.4x	$580.4M 21.5x	$2,326.1M 25.1x	$3,108.3M 24.6x	$171.5M 23.1x	$335.0M 20.2x	$286.3M 13.0x	$263.8M 19.3x

Source: Capital IQ as of 5/10/2021.

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Definitions & Terms

- "~" = Approximately
- "**A/S**" = Ancillary Services
- "**CLR**" = Controllable Load Resource
- "**DAC**" = Direct Air Capture
- "**Difficulty**" = Measure of how difficult it is to mine a bitcoin block; difficulty is adjusted every ~2 weeks so that the average time between each block mined remains 10 minutes
- "**Efficiency**" = As applied to miners, the electricity used per hash, typically expressed in J/TH
- "**E**" = When used in connection with any date or amount means the information related thereto is estimated or projected
- "**EH/s**" = Exahash per second, a measure of hashrate
- "**EH**" = Exahash or 10^18 hashes or 1,000,000 terahashes
- "**Hash**" = a calculation that converts an input of letters and numbers into an encrypted output
- "**Hashrate**" = The number of hashes a miner can perform in each second, typically expressed in EH/S or TH/S and used as a measure of computational power or mining capacity used to mine and process transactions on a blockchain such as bitcoin
- "**J/TH**" = Joules per terahash, a measure of miner efficiency
- "**LaaR**" = Load-as-a-Resource
- "**LTM**" = Last twelve months
- "**Mining capacity**" = Nameplate hashrate as specified by mining hardware manufacturers; actual operating performance may differ from mining capacity
- "**MW**" = Megawatt, a measure of instantaneous electrical demand or capacity equal to 1,000,000 watts
- "**MWh**" = Megawatt-hour, a measure of the electricity (expressed in MW) consumed or generated in an hour
- "**NPRR**" = Nodal Protocol Revision Requests
- "**TH**" = Terahash or 10^12 hashes
- "**TH/s**" = Terahash per second; a measure of hashrate

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INVESTOR PRESENTATION

May 2021 | CONFIDENTIAL

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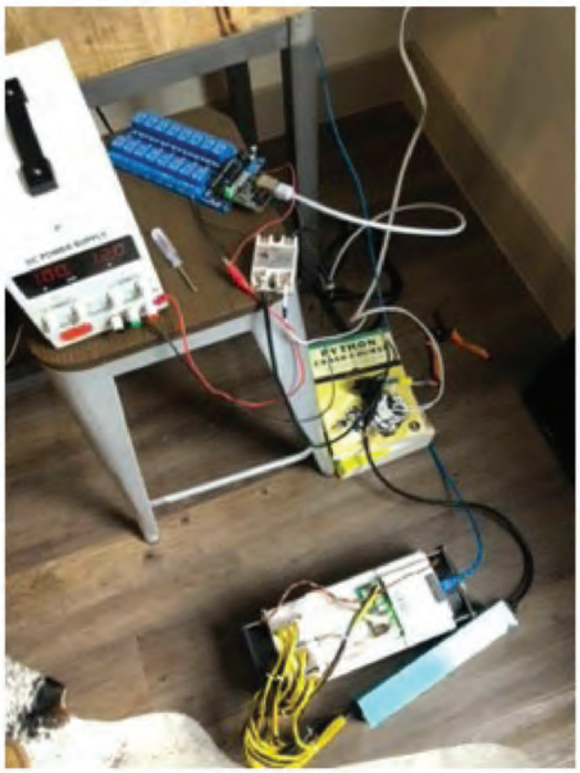
BTIG, LLC is a global financial services firm specializing in institutional trading, investment banking, equity research, and related brokerage services.



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21-cv-00534

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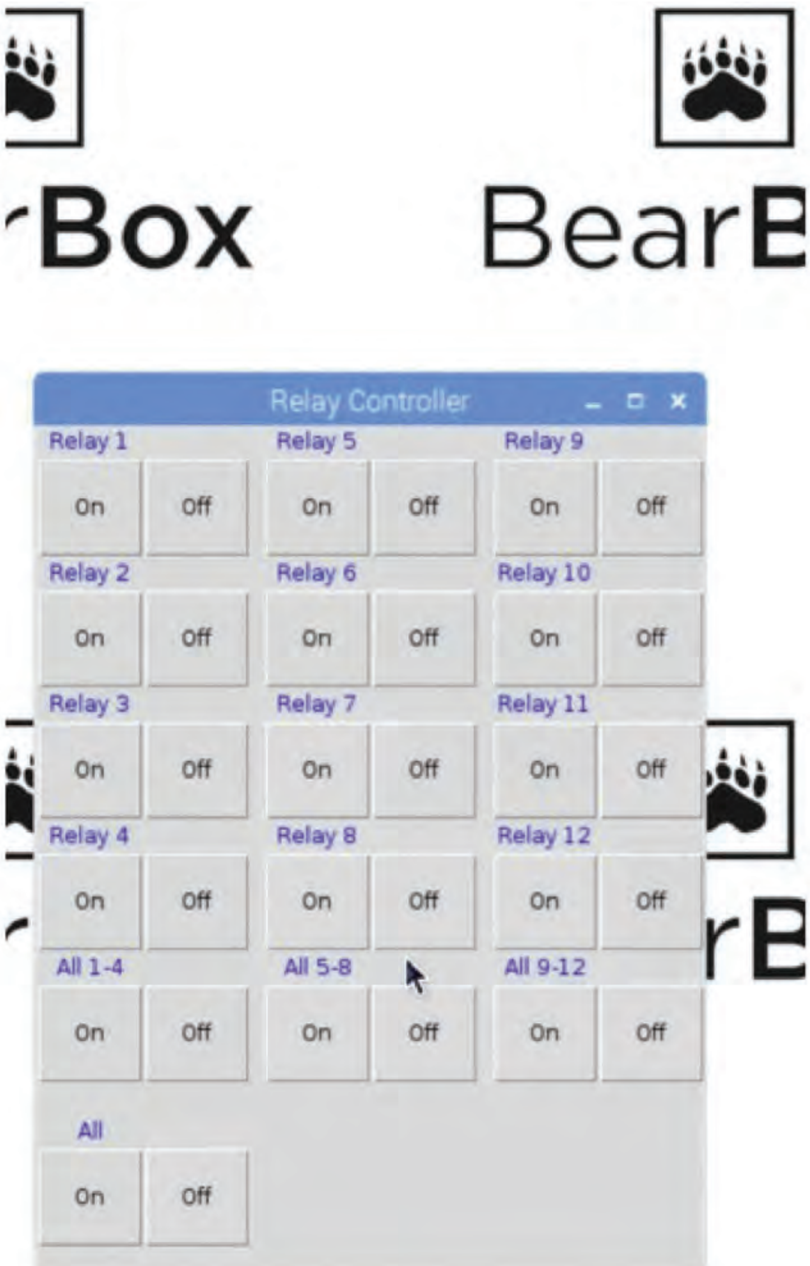

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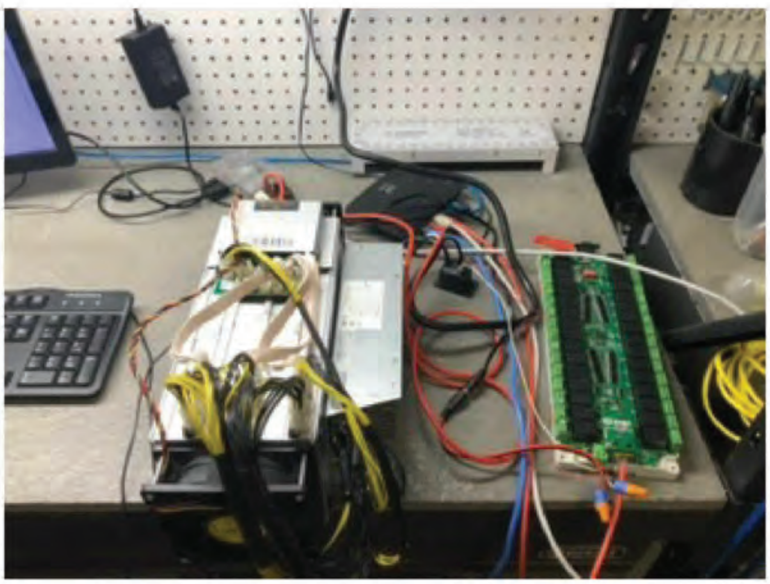

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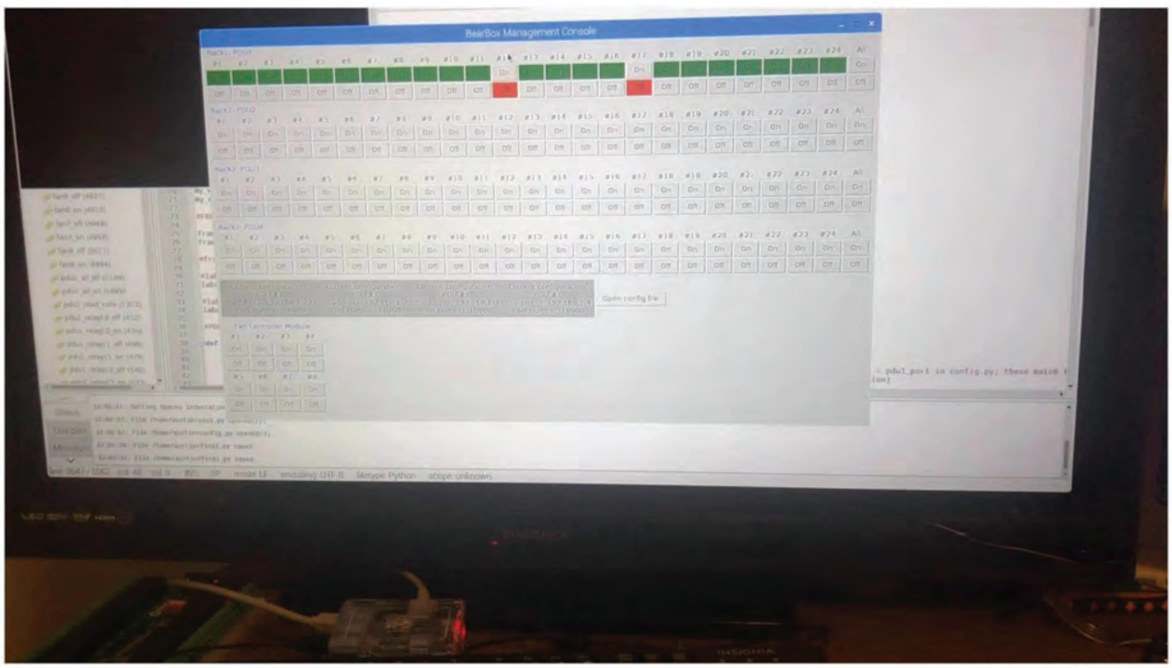

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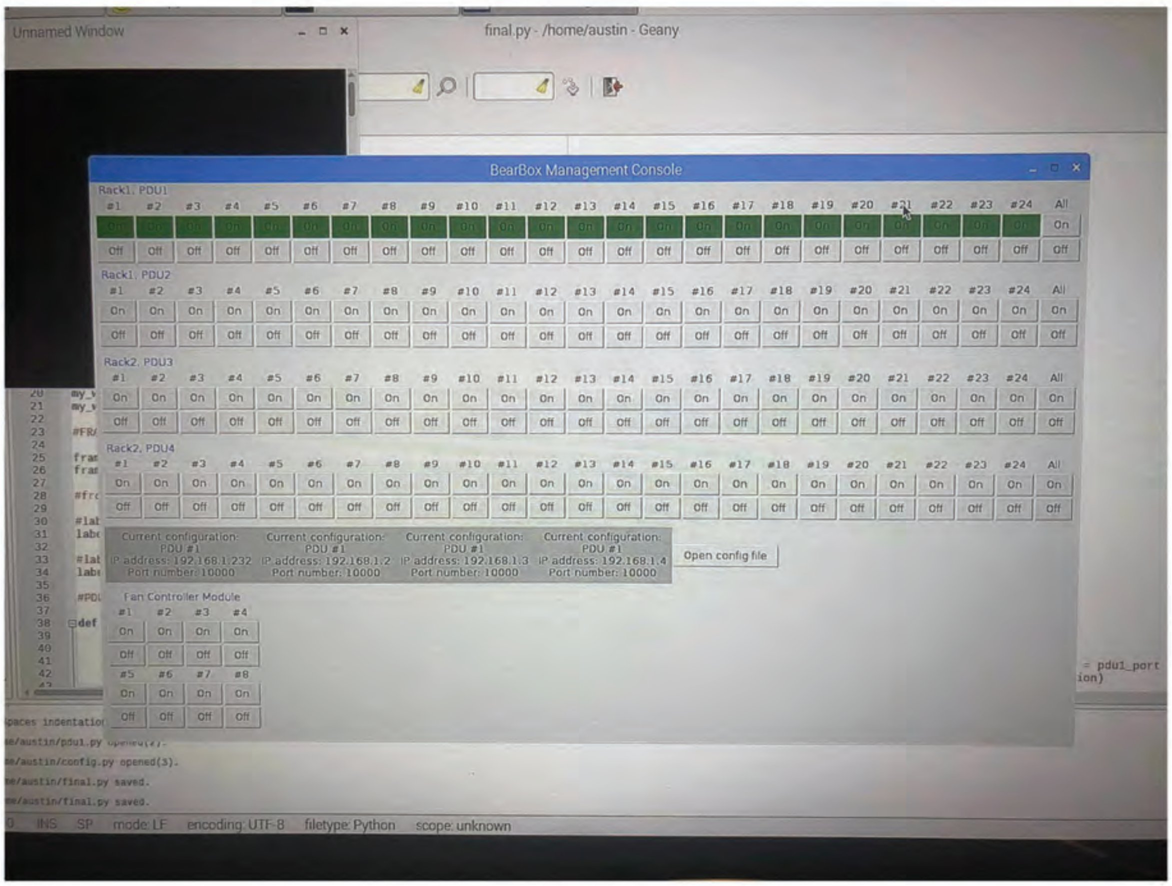

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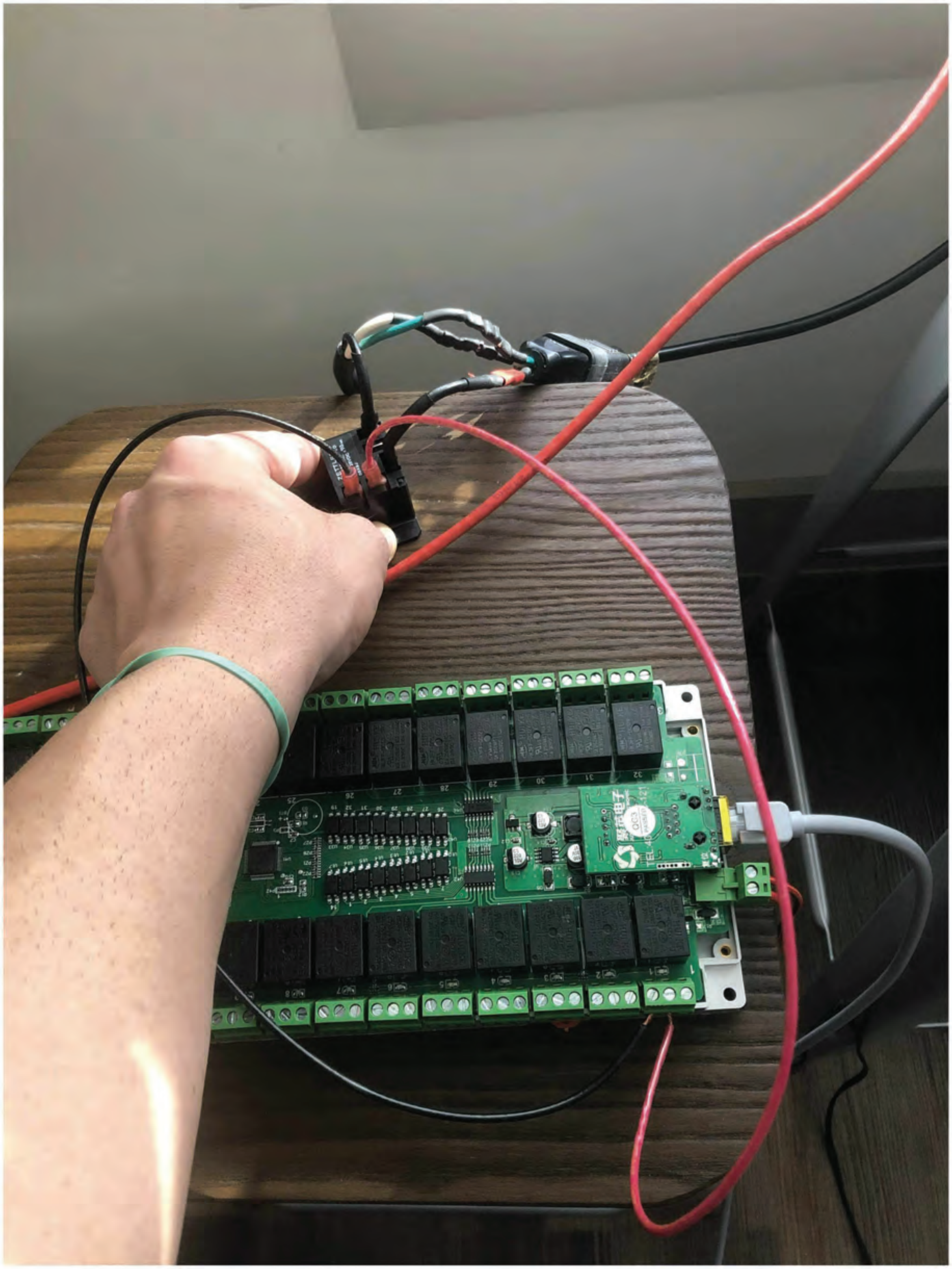

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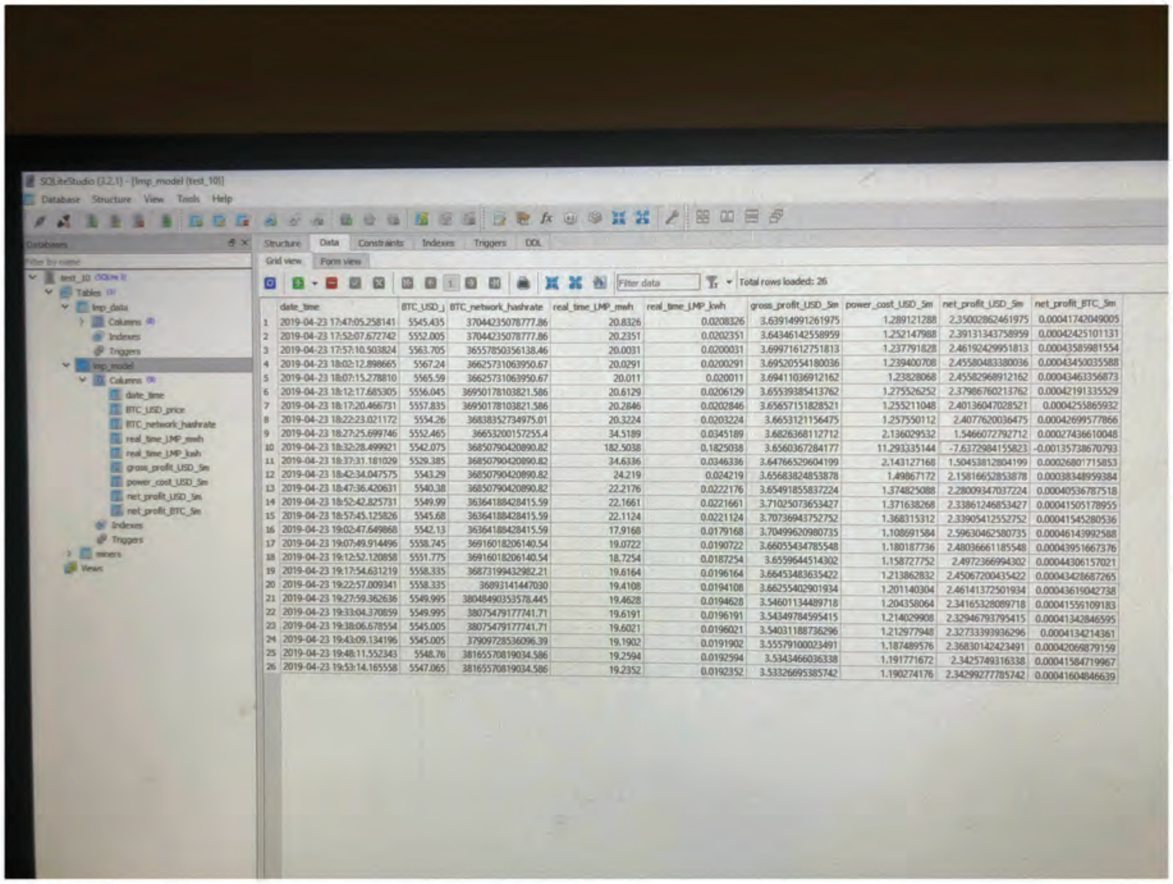

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3	2019-04-23 17:57:10.503824	5563.705	36557850356138.46	20.0031	0.0200031	3.69971612751813	1.237791828	2.46192429951813	0.00043585981554
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6	2019-04-23 18:12:17.685305	5556.045	36950178103821.586	20.6129	0.0206129	3.65539385413762	1.275526252	2.37986760213762	0.00042191335529
7	2019-04-23 18:17:20.466731	5557.835	36950178103821.586	20.2846	0.0202846	3.65657151828521	1.255211048	2.40136047028521	0.0004255865932
8	2019-04-23 18:22:23.021172	5554.26	36838352734975.01	20.3224	0.0203224	3.6653121156475	1.257550112	2.4077620036475	0.00042699577866
9	2019-04-23 18:27:25.699746	5552.465	36653200157255.4	34.5189	0.0345189	3.68263681127l2	2.136029532	1.5466072792712	0.00027436610048
10	2019-04-23 18:32:28.499921	5542.075	36850790420890.82	182.5038	0.1825038	3.6560367284177	11.293335144	-7.6372984155823	-0.00135738670793
11	2019-04-23 18:37:31.181029	5529.385	36850790420890.82	34.6336	0.0346336	3.64766529604199	2.143127168	1.50453812804199	0.00026801715853
12	2019-04-23 18:42:34.047575	5543.29	36850790420890.82	24.219	0.024219	3.65683824853878	1.49867172	2.15816652853878	0.00038348959384
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20	2019-04-23 19:22:57.009341	5558.335	36893141447030	19.4108	0.0194108	3.66255402901934	1.201140304	2.46141372501934	0.00043619042738
21	2019-04-23 19:27:59.362636	5549.995	38048490353578.445	19.4628	0.0194628	3.54601134489718	1.204358064	2.34165328089718	0.00041559109183
22	2019-04-23 19:33:04.370859	5549.995	38075479177741.71	19.6191	0.0196191	3.54349784595415	1.214029908	2.32946793795415	0.00041342846595
23	2019-04-23 19:38:06.678554	5545.005	38075479177741.71	19.6021	0.0196021	3.54031188736296	1.212977948	2.32733393936296	0.0004134214361
24	2019-04-23 19:43:09.134196	5545.005	37909728536096.39	19.1902	0.0191902	3.55579100023491	1.187489576	2.36830142423491	0.00042069879159
25	2019-04-23 19:48:11.552343	5548.76	38165570819034.586	19.2594	0.0192594	3.5343466036338	1.191771672	2.3425749316338	0.00041584719967
26	2019-04-23 19:53:14.165558	5547.065	38165570819034.586	19.2352	0.0192352	3.53326695385742	1.190274176	2.34299277785742	0.00041604846639

TX143
BearBox v. Lancium
21-cv-00534

Metadata report for BB00000052

BEGPROD	BB00000052
ENDPROD	BB00000052
CUSTODIAN	Storms, Austin
FILENAME	57776007234__2BB185B5-C6C7-46CD-B355-A20A49854F4D.JPG
DATE CREATED	4/23/2019 7:54:00 PM
DATE MODIFIED	4/23/2019 7:54:00 PM

TX143.0002

Day-ahead vs. RTBM LMP biz requirements and data questions

From: Austin Storms <austin@bearbox.io>
To: Denis Labij <dlabij@glidepath.net>, Mike Hoadley <mhoadley@glidepath.net>, Chris Vickery <cvickery@glidepath.net>
Cc: Ben Hakes <ben@paretoadvisors.com>
Date: Wed, 24 Apr 2019 23:17:24 -0500

Hey guys,

I've been working on some code for the miner management system that integrates RTBM LMP profitability checks - but have a few questions regarding business requirements and available data feeds.

From my understanding, the day-ahead LMP $/MWh is calculated based on forecast estimated demand and the RTBM LMP $/MWh fills the gap between the estimated demand in day-ahead market and actual demand in real-time... is this correct?

The data modeling and system I've been building fetches RTBM LMP price and compares the profitability of selling load @ RTBM LMP vs. using the same load to mine Bitcoin, but I'm not exactly sure what the business requirements are - and I'm looking for a bit of guidance to build the model to show contrasted profitability.

The data feed I've been utilizing is from the SPP marketplace - see link here to the 5-minute RTBM (https://marketplace.spp.org/file-api/download/rtbm-lmp-by-location?path=%2FRTBM-LMP-SL-latestInterval.csv). The only problem with fetching the .csv file is that it's a bit finicky - *is there another data feed that Glide Path uses to get RTBM LMP pricing at specific node location?* SPP mentions an FTP server in some of their Feb '18 published documentation, but I've yet to successfully authenticate to that server.

As always, I appreciate your time, consideration, and helpful input!

Thanks and talk soon,

Austin

Austin M. Storms
BearBox, LLC
611 O' Keefe Avenue
New Orleans, LA 70113
austin@bearbox.io

TX146
BearBox v. Lancium
21-cv-00534

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
47:05.3	5545.435	3.70442E+13	20.8326	0.0208326	3.639149913	1.289121288	2.350028625	0.00041742	
52:07.7	5552.005	3.70442E+13	20.2351	0.0202351	3.643461426	1.252147988	2.391313438	0.000424251	
57:10.5	5563.705	3.65579E+13	20.0031	0.0200031	3.699716128	1.237791828	2.4619243	0.00043586	
02:12.9	5567.24	3.66257E+13	20.0291	0.0200291	3.695205542	1.239400708	2.455804834	0.0004345	
07:15.3	5565.59	3.66257E+13	20.011	0.020011	3.694110369	1.23828068	2.455829689	0.000434634	
12:17.7	5556.045	3.69502E+13	20.6129	0.0206129	3.655393854	1.275526252	2.379867602	0.000421913	
17:20.5	5557.835	3.69502E+13	20.2846	0.0202846	3.656571518	1.255211048	2.40136047	0.000425587	
22:23.0	5554.26	3.68384E+13	20.3224	0.0203224	3.665312116	1.257550112	2.407762004	0.000426996	
27:25.7	5552.465	3.66532E+13	34.5189	0.0345189	3.682636811	2.136029532	1.546607279	0.000274366	
32:28.5	5542.075	3.68508E+13	182.5038	0.1825038	3.656036728	11.29333514	-7.637298416	-0.001357387	
37:31.2	5529.385	3.68508E+13	34.6336	0.0346336	3.647665296	2.143127168	1.504538128	0.000268017	
42:34.0	5543.29	3.68508E+13	24.219	0.024219	3.656838249	1.49867172	2.158166529	0.00038349	
47:36.4	5540.38	3.68508E+13	22.2176	0.0222176	3.654918558	1.374825088	2.28009347	0.000405368	
52:42.8	5549.99	3.63642E+13	22.1661	0.0221661	3.710250737	1.371638268	2.338612469	0.000415052	
57:45.1	5545.68	3.63642E+13	22.1124	0.0221124	3.707369438	1.368315312	2.339054126	0.000415453	
02:47.6	5542.13	3.63642E+13	17.9168	0.0179168	3.70499621	1.108691584	2.596304626	0.00046144	
07:49.9	5558.745	3.6916E+13	19.0722	0.0190722	3.660554348	1.180187736	2.480366612	0.000439517	
12:52.1	5551.775	3.6916E+13	18.7254	0.0187254	3.655964451	1.158727752	2.497236699	0.000443062	
17:54.6	5558.335	3.68732E+13	19.6164	0.0196164	3.664534836	1.213862832	2.450672004	0.000434287	
22:57.0	5558.335	3.68931E+13	19.4108	0.0194108	3.662554029	1.201140304	2.461413725	0.00043619	
27:59.4	5549.995	3.80485E+13	19.4628	0.0194628	3.546011345	1.204358064	2.341653281	0.000415591	
33:04.4	5549.995	3.80755E+13	19.6191	0.0196191	3.543497846	1.214029908	2.329467938	0.000413428	
38:06.7	5545.005	3.80755E+13	19.6021	0.0196021	3.540311887	1.212977948	2.327333939	0.000413421	
43:09.1	5545.005	3.79097E+13	19.1902	0.0191902	3.555791	1.187489576	2.368301424	0.000420699	
48:11.6	5548.76	3.81656E+13	19.2594	0.0192594	3.534346604	1.191771672	2.342574932	0.000415847	
53:14.2	5547.065	3.81656E+13	19.2352	0.0192352	3.533266954	1.190274176	2.342992778	0.000416048	
58:16.6	5540.005	3.81656E+13	19.4548	0.0194548	3.528770006	1.203863024	2.324906982	0.000413363	
02:58.6	5532.415	3.78431E+13	19.996	0.019996	3.55396084	1.23735248	2.31660836	0.000412453	
08:01.5	5526.815	3.78431E+13	19.9585	0.0199585	3.550363464	1.23503198	2.315331484	0.000412643	
09:44.0	5534.385	3.78431E+13	19.9585	0.0199585	3.501897951	1.23503198	2.266865971	0.000409597	
14:46.8	5523.785	3.78431E+13	20.6482	0.0206482	3.49519077	1.277710616	2.217480154	0.000401442	
19:49.2	5504.455	3.75601E+13	20.8866	0.0208866	3.509205132	1.292462808	2.216742324	0.000402718	
24:52.2	5520.97	3.74544E+13	20.7098	0.0207098	3.529665934	1.281522424	2.24814351	0.000407201	
29:54.8	5519.67	3.74544E+13	20.5716	0.0205716	3.528834818	1.272970608	2.25586421	0.000408695	
34:57.7	5529.995	3.78134E+13	20.506	0.020506	3.501870124	1.26891128	2.232958844	0.00040379	
40:00.7	5530.355	3.78134E+13	20.5223	0.0205223	3.502098094	1.269919924	2.23217817	0.000403623	
45:04.0	5558.305	3.78134E+13	22.4144	0.0224144	3.519797436	1.387003072	2.132794364	0.000383713	
50:06.7	5554.995	3.78134E+13	21.8661	0.0218661	3.517701378	1.353074268	2.16462711	0.000389672	
55:09.4	5551.66	3.78134E+13	20.9725	0.0209725	3.515589489	1.2977783	2.217811189	0.000399486	
00:11.9	5546.015	3.78134E+13	21.8302	0.0218302	3.512014792	1.350852776	2.161162016	0.000389678	
05:22.3	5547.005	3.78134E+13	22.8116	0.0228116	3.512641709	1.423369948	2.089271761	0.000376649	
10:25.1	5554.265	3.78134E+13	21.6736	0.0216736	3.517239105	1.341162368	2.176076737	0.000391785	
15:27.7	5563.805	3.68388E+13	21.6736	0.0216736	3.616496105	1.341162368	2.275333737	0.000408953	
20:30.2	5554.255	3.68388E+13	20.8878	0.0208878	3.610288566	1.292537064	2.317751502	0.000417293	
25:32.6	5557.215	3.72342E+13	20.9929	0.0209929	3.57384877	1.299040652	2.274808118	0.000409343	

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
30:35.7	5553.07	3.72342E+13	21.1417	0.0211417	3.571183118	1.308248396	2.262934722	0.000407511	
35:38.1	5550.645	3.72342E+13	21.0629	0.0210629	3.569623599	1.303372252	2.266251347	0.000408286	
40:40.6	5549.215	3.72342E+13	21.0368	0.0210368	3.568703965	1.301757184	2.266946781	0.000408517	
45:43.9	5551.05	3.68815E+13	21.0009	0.0210009	3.604024065	1.299535692	2.304488373	0.000415145	
50:46.9	5559.28	3.70535E+13	20.323	0.020323	3.592617652	1.25758724	2.335030412	0.000420024	
55:49.5	5557.005	3.70535E+13	20.7769	0.0207769	3.59114746	1.285674572	2.305472888	0.000414877	
55:57.6	5557.005	3.70535E+13	20.7769	0.0207769	3.052475341	1.285674572	1.766800769	0.000317941	
58:10.1	5556.995	3.70535E+13	20.7769	0.0207769	3.591140998	1.285674572	2.305466426	0.000414876	
03:12.7	5560.57	3.70447E+13	20.3575	0.0203575	3.594305246	1.2597221	2.334583146	0.000419846	
08:15.0	5566.145	3.70447E+13	20.0735	0.0200735	3.597908879	1.24214818	2.355760699	0.00042323	
13:17.6	5563.005	3.70447E+13	19.1393	0.0191393	3.595879209	1.184339884	2.411539325	0.000433496	
18:20.4	5563.835	3.70447E+13	19.635	0.019635	3.596415714	1.2150138	2.381401914	0.000428014	
23:23.0	5566.615	3.65415E+13	19.3796	0.0193796	3.647754767	1.199209648	2.448545119	0.000439862	
28:25.8	5571.385	3.65415E+13	19.0586	0.0190586	3.650880507	1.179346168	2.471534339	0.000443612	
33:28.4	5574.675	3.65415E+13	18.8628	0.0188628	3.653036415	1.167230064	2.485806351	0.000445911	
38:30.9	5580.625	3.65415E+13	18.6719	0.0186719	3.656109732	1.155417172	2.50069256	0.000448204	
43:33.4	5582.045	3.60928E+13	18.7675	0.0187675	3.703340738	1.1613329	2.542007838	0.00045539	
48:36.2	5580.215	3.60928E+13	19.1751	0.0191751	3.702126646	1.186555188	2.515571458	0.000450802	
53:38.7	5577.735	3.60928E+13	19.0124	0.0190124	3.70048132	1.176487312	2.523994008	0.000452512	
58:41.1	5574.885	3.60928E+13	19.2541	0.0192541	3.698590522	1.191443708	2.507146814	0.000449722	
03:43.8	5568.435	3.60928E+13	20.3912	0.0203912	3.694311347	1.261807456	2.432503891	0.000436838	
08:47.0	5569.875	3.60928E+13	18.826	0.018826	3.695266697	1.16495288	2.530313817	0.000454286	
13:49.7	5577.995	3.64585E+13	19.839	0.019839	3.663533467	1.22763732	2.435896147	0.000436697	
18:52.6	5601.505	3.64585E+13	19.597	0.019597	3.67897444	1.21266236	2.46631208	0.000440295	
23:55.0	5612.165	3.64224E+13	18.5737	0.0185737	3.689628441	1.149340556	2.540287885	0.00045264	
28:57.5	5602.725	3.64192E+13	18.6497	0.0186497	3.683750042	1.154043436	2.529706606	0.000451514	
34:00.0	5596.005	3.64192E+13	18.6447	0.0186447	3.679331692	1.153734036	2.525597656	0.000451322	
39:02.1	5598.175	3.64192E+13	18.8322	0.0188322	3.680758451	1.165336536	2.515421915	0.000449329	
44:04.6	5596.115	3.62458E+13	18.8421	0.0188421	3.69700138	1.165949148	2.531052232	0.000452287	
49:06.8	5604.25	3.62138E+13	18.8223	0.0188223	3.70565435	1.164723924	2.540930426	0.000453393	
54:27.8	5601.24	3.66758E+13	18.7356	0.0187356	3.657008833	1.159358928	2.497649905	0.00044591	
59:30.0	5598.575	3.66758E+13	18.6458	0.0186458	3.655268874	1.153802104	2.50146677	0.000446804	
04:32.6	5598.515	3.66553E+13	18.6794	0.0186794	3.657276783	1.155881272	2.501395511	0.000446796	
09:35.0	5596.585	3.75605E+13	18.5245	0.0185245	3.567899006	1.14629606	2.421602946	0.000432693	
14:38.1	5582.795	3.75605E+13	18.5028	0.0185028	3.56036997	1.144953264	2.415416706	0.0004325	
19:42.0	5579.905	3.75605E+13	18.4381	0.0184381	3.557265279	1.140949628	2.416315651	0.000433039	
24:44.7	5582.975	3.73924E+13	18.3366	0.0183366	3.575227025	1.134668808	2.440558217	0.000437143	
29:47.4	5587.215	3.73272E+13	18.4354	0.0184354	3.584193667	1.140782552	2.443411115	0.000437322	
34:49.7	5593.545	3.79414E+13	18.3981	0.0183981	3.530168822	1.138474428	2.391694394	0.000427581	
39:52.3	5599.96	3.79414E+13	18.3636	0.0183636	3.534217423	1.136339568	2.397877855	0.000428196	
44:55.0	5599.405	3.79414E+13	18.2911	0.0182911	3.533867154	1.131853268	2.402013886	0.000428977	
49:57.8	5598.435	3.79414E+13	18.1887	0.0181887	3.533254973	1.125516756	2.407738217	0.000430073	
55:00.5	5592.145	3.76443E+13	18.2217	0.0182217	3.557134802	1.127558796	2.429576006	0.000434462	
00:03.2	5600.135	3.76443E+13	18.2136	0.0182136	3.5622172	1.127057568	2.435159632	0.000434839	
05:06.3	5600.435	3.76443E+13	19.9736	0.0199736	3.562408029	1.235966368	2.326441661	0.000415404	

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
10:20.4	5615.985	3.73962E+13	18.3891	0.0183891	3.595996353	1.137917508	2.458078845	0.000437693	
15:23.1	5617.84	3.73962E+13	18.3638	0.0183638	3.597184136	1.136351944	2.460832192	0.000438039	
20:25.4	5613.235	3.73962E+13	18.3379	0.0183379	3.594235488	1.134749252	2.459486236	0.000438158	
25:27.9	5605.375	3.84109E+13	18.3088	0.0183088	3.494388541	1.132948544	2.361439997	0.000421281	
30:30.4	5613.405	3.84109E+13	18.3285	0.0183285	3.49939444	1.13416758	2.36522686	0.000421353	
35:32.8	5600.085	3.86987E+13	18.3114	0.0183114	3.465126471	1.133109432	2.332017039	0.000416425	
40:35.2	5608.255	3.98702E+13	18.3114	0.0183114	3.368223748	1.133109432	2.235114316	0.00039854	
45:37.6	5596.305	4.03412E+13	18.1397	0.0181397	3.321799234	1.122484636	2.199314598	0.000392994	
50:40.3	5590.55	4.03412E+13	18.2302	0.0182302	3.318383238	1.128084776	2.190298462	0.000391786	
55:43.5	5592.765	4.04864E+13	18.2457	0.0182457	3.307796211	1.129043916	2.178752295	0.000389566	
00:46.1	5592.005	4.03566E+13	18.1795	0.0181795	3.317979167	1.12494746	2.193031707	0.000392173	
05:49.2	5599.875	4.06664E+13	18.1933	0.0181933	3.297340692	1.125801404	2.171539288	0.000387784	
10:51.5	5599.775	4.06664E+13	18.2113	0.0182113	3.29728181	1.126915244	2.170366566	0.000387581	
15:54.6	5591.44	4.06664E+13	18.2097	0.0182097	3.292373962	1.126816236	2.165557726	0.000387299	
20:57.2	5589.505	4.0389E+13	18.1905	0.0181905	3.313838884	1.12562814	2.188210744	0.000391486	
26:04.2	5585.765	4.02505E+13	18.2103	0.0182103	3.323018264	1.126853364	2.1961649	0.000393172	
31:06.5	5571.345	4.02505E+13	18.2796	0.0182796	3.314439686	1.131141648	2.183298038	0.00039188	
36:08.7	5569.38	4.11054E+13	18.2827	0.0182827	3.244357919	1.131333476	2.113024443	0.0003794	
41:11.5	5545.35	4.11054E+13	18.3112	0.0183112	3.230359606	1.133097056	2.09726255	0.000378202	
46:18.0	5537.22	4.10982E+13	18.2679	0.0182679	3.226190506	1.130417652	2.095772854	0.000378488	
51:20.5	5459.965	4.10982E+13	18.2786	0.0182786	3.181178867	1.131079768	2.050099099	0.000375478	
56:23.2	5462.54	4.1882E+13	18.2294	0.0182294	3.123117773	1.128035272	1.995082501	0.00036523	
01:25.5	5465.005	4.27878E+13	18.2092	0.0182092	3.058384525	1.126785296	1.931599229	0.000353449	
06:29.0	5483.83	4.27878E+13	18.1959	0.0181959	3.068919573	1.125962292	1.942957281	0.000354307	
11:31.3	5465.03	4.27878E+13	18.1072	0.0181072	3.058398516	1.120473536	1.93792498	0.000354605	
16:34.0	5465.055	4.27878E+13	18.1536	0.0181536	3.058412507	1.123344768	1.935067739	0.00035408	
21:37.2	5458.095	4.27878E+13	18.1089	0.0181089	3.054517477	1.120578732	1.933938745	0.000354325	
26:39.9	5474.395	4.22746E+13	18.0707	0.0180707	3.100831014	1.118214916	1.982616098	0.000362162	
31:42.3	5467.56	4.22746E+13	18.0359	0.0180359	3.096959503	1.116061492	1.980898011	0.0003623	
36:44.9	5476.79	4.28539E+13	18.0618	0.0180618	3.060253698	1.117664184	1.942589514	0.000354695	
41:47.9	5476.34	4.29415E+13	18.0474	0.0180474	3.053754735	1.116773112	1.936981623	0.0003537	
46:50.6	5486.03	4.29821E+13	18.0949	0.0180949	3.056269568	1.119712412	1.936557156	0.000352998	
51:53.2	5484.985	4.29821E+13	18.0871	0.0180871	3.055687398	1.119229748	1.93645765	0.000353047	
56:56.0	5483.265	4.29821E+13	17.9518	0.0179518	3.054729185	1.110857384	1.943871801	0.00035451	
01:58.7	5475.005	4.29821E+13	17.9116	0.0179116	3.050127536	1.108369808	1.941757728	0.000354659	
07:01.1	5467.095	4.29821E+13	17.8176	0.0178176	3.045720872	1.102553088	1.943167784	0.00035543	
09:19.7	5455.275	4.63648E+13	20.5	0.0205	2.817404288	1.26854	1.548864288	0.00028392	
14:22.3	5456.915	4.70896E+13	20.7237	0.0207237	2.774873303	1.282382556	1.492490747	0.000273504	
19:24.6	5460.145	4.70896E+13	24.1941	0.0241941	2.776515777	1.497130908	1.279384869	0.000234313	
24:27.0	5462	4.70896E+13	23.5757	0.0235757	2.777459055	1.458864316	1.318594739	0.000241412	
29:29.6	5456.055	4.70896E+13	24.3596	0.0243596	2.774435988	1.507372048	1.26706394	0.000232231	
34:32.2	5457.915	4.70896E+13	24.047	0.024047	2.775381809	1.48802836	1.287353449	0.000235869	
39:34.6	5464.405	4.70896E+13	21.5065	0.0215065	2.778682012	1.33082222	1.447859792	0.000264962	
44:37.2	5466.095	4.70896E+13	21.1226	0.0211226	2.779541387	1.307066488	1.472474899	0.000269383	
49:39.7	5463.235	4.70896E+13	22.2626	0.0222626	2.777822637	1.377609688	1.400212949	0.000256322	

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
54:42.0	5466.21	4.70896E+13	21.7086	0.0217086	2.779599865	1.343328168	1.436271697	0.000262755	
59:44.8	5463.885	4.70896E+13	24.9377	0.0249377	2.778417589	1.543144876	1.235272713	0.00022608	
04:47.5	5465.985	4.70896E+13	24.4011	0.0244011	2.779485451	1.509940068	1.269545383	0.000232263	
09:49.9	5466.325	4.50136E+13	20.9728	0.0209728	2.907858017	1.297796864	1.610061153	0.000294542	
14:52.5	5470.115	4.56213E+13	22.2104	0.0222104	2.871111553	1.374379552	1.496732001	0.00027362	
19:55.0	5471.765	4.56213E+13	20.8365	0.0208365	2.871977592	1.28936262	1.582614972	0.000289233	
24:57.2	5468.165	4.56213E+13	20.7846	0.0207846	2.870088052	1.286151048	1.583937004	0.000289665	
29:59.8	5469.865	4.56213E+13	20.9997	0.0209997	2.870980335	1.299461436	1.571518899	0.000287305	
35:02.6	5472.65	4.56213E+13	21.0244	0.0210244	2.872442104	1.300989872	1.571452232	0.000287146	
40:07.2	5480.15	4.55864E+13	21.2693	0.0212693	2.878582829	1.316144284	1.562438545	0.000285109	
45:09.3	5471.06	4.55864E+13	22.0306	0.0220306	2.873808084	1.363253528	1.510554556	0.000276099	
50:11.6	5468.325	4.55864E+13	21.1827	0.0211827	2.872371459	1.310785476	1.561585983	0.000285569	
55:13.9	5469.885	4.55864E+13	22.288	0.022288	2.873190887	1.37918144	1.494009447	0.000273134	
02:34.5	5468.155	4.55864E+13	21.7609	0.0217609	2.872282162	1.346564492	1.52571767	0.000279019	
26:23.8	5438.905	4.52737E+13	21.8561	0.0218561	2.876646002	1.352455468	1.524190534	0.000280238	
31:26.3	5444.905	4.50743E+13	21.3399	0.0213399	2.892561271	1.320513012	1.572048259	0.000288719	
36:28.9	5438.9	4.49703E+13	21.6162	0.0216162	2.896053263	1.337610456	1.558442807	0.000286536	
41:31.7	5426.755	4.49703E+13	20.4926	0.0204926	2.88958641	1.268082088	1.621504322	0.000298798	
43:52.1	5431.415	4.49703E+13	20.4926	0.0204926	2.892067722	1.268082088	1.623985634	0.000298999	573040
48:54.6	5448.185	4.45997E+13	21.0768	0.0210768	2.925101839	1.304232384	1.620869455	0.000297506	573040
53:57.6	5449.995	4.45997E+13	20.7538	0.0207538	2.926073619	1.284245144	1.641828475	0.000301253	573041
59:00.1	5442.01	4.56353E+13	20.8049	0.0208049	2.855484482	1.287407212	1.56807727	0.000288143	573041
04:02.6	5440.765	4.56353E+13	21.0461	0.0210461	2.854831216	1.302332668	1.552498548	0.000285346	573043
09:05.6	5447.005	4.56353E+13	21.1442	0.0211442	2.858105415	1.308403096	1.549702319	0.000284505	573043
14:08.4	5450.335	4.56353E+13	21.1124	0.0211124	2.859852704	1.306435312	1.553417392	0.000285013	573043
19:10.8	5439.425	4.56353E+13	21.2043	0.0212043	2.854128103	1.312122084	1.542006019	0.000283487	573043
24:13.3	5440.165	4.6183E+13	21.1452	0.0211452	2.820660506	1.308464976	1.51219553	0.000277969	573045
29:15.9	5441.045	4.6183E+13	21.1219	0.0211219	2.821116776	1.307023172	1.514093604	0.000278273	573045
34:18.4	5435.965	4.78332E+13	21.6911	0.0216911	2.721247186	1.342245268	1.379001918	0.000253681	573047
39:21.5	5428.32	4.85827E+13	21.9173	0.0219173	2.675500037	1.356242524	1.319257513	0.000243032	573047
44:24.7	5416.935	4.85827E+13	21.94	0.02194	2.66988862	1.3576472	1.31224142	0.000242248	573050
49:27.5	5433.455	4.84296E+13	21.5717	0.0215717	2.68649443	1.334856796	1.351637634	0.000248762	573050
54:30.0	5428.96	4.88968E+13	21.9922	0.0219922	2.658624641	1.360877336	1.297747305	0.000239042	573050
59:32.9	5415.855	4.9388E+13	21.6818	0.0216818	2.625829462	1.341669784	1.284159678	0.000237111	573055
04:43.7	5422.69	4.99638E+13	21.6371	0.0216371	2.59884628	1.338903748	1.259942532	0.000232346	573055
09:50.1	5419.675	5.02837E+13	21.6448	0.0216448	2.580874033	1.339380224	1.241493809	0.000229072	573055
15:06.5	5395.06	5.06626E+13	21.4283	0.0214283	2.549938259	1.325983204	1.223955055	0.000226866	573058
20:09.0	5392.495	5.07939E+13	21.1117	0.0211117	2.542140278	1.306391996	1.235748282	0.000229161	573060
25:12.3	5387.415	5.07939E+13	20.9265	0.0209265	2.539745455	1.29493182	1.244813635	0.00023106	573060
30:15.2	5391.645	5.06329E+13	21.0162	0.0210162	2.549822478	1.300482456	1.249340022	0.000231718	573061
35:17.7	5379.725	5.06329E+13	21.2577	0.0212577	2.544185259	1.315426476	1.228758783	0.000228406	573061
40:39.7	5391.645	5.06329E+13	21.1103	0.0211103	2.548065576	1.306305364	1.241760212	0.000230471	573062
45:42.8	5388.695	5.04503E+13	21.1505	0.0211505	2.557648657	1.30879294	1.248855717	0.000231755	573063
50:46.9	5390.105	5.05578E+13	21.0517	0.0210517	2.552878265	1.302679196	1.250199069	0.000231943	573064
55:51.7	5390.055	5.08736E+13	21.0985	0.0210985	2.537008872	1.30557518	1.231433692	0.000228464	573063

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
01:01.6	5401.205	5.08736E+13	21.8183	0.0218183	2.542256991	1.350116404	1.192140587	0.000220718	573065
06:07.1	5425.895	5.13491E+13	21.3116	0.0213116	2.530229304	1.318761808	1.211467496	0.000223275	573066
11:10.2	5432.005	5.38257E+13	21.251	0.021251	2.416528414	1.31501188	1.101516534	0.000202783	573068
16:12.7	5428.595	5.38257E+13	21.0997	0.0210997	2.415011412	1.305649436	1.109361976	0.000204355	573068
21:17.2	5431.415	5.36598E+13	22.5278	0.0225278	2.423733237	1.394020264	1.029712973	0.000189585	573069
26:19.9	5433.995	5.36598E+13	22.2184	0.0222184	2.424884545	1.374874592	1.050009953	0.00019323	573069
31:22.3	5428.365	5.42969E+13	23.7172	0.0237172	2.393948889	1.467620336	0.926328553	0.000170646	573071
36:25.2	5432.4	5.42969E+13	23.6925	0.0236925	2.395728354	1.4660919	0.929636454	0.000171128	573069
41:32.3	5438.36	5.40326E+13	25.6011	0.0256011	2.41008904	1.584196068	0.825892972	0.000151864	573071
46:34.8	5438.36	5.44151E+13	25.1796	0.0251796	2.393146829	1.558113648	0.835033181	0.000153545	573072
51:37.7	5431.56	5.53862E+13	24.9008	0.0249008	2.348249136	1.540861504	0.807387632	0.000148647	573074
56:40.3	5430.56	5.53862E+13	23.387	0.023387	2.347816802	1.44718756	0.900629242	0.000165845	573074
01:48.8	5432.095	5.53862E+13	23.4593	0.0234593	2.348480435	1.451661484	0.896818951	0.000165096	573074
06:51.1	5435.66	5.44686E+13	23.1093	0.0231093	2.389613405	1.430003484	0.959609921	0.00017654	573074
11:55.0	5441.88	5.44686E+13	23.0413	0.0230413	2.392347828	1.425795644	0.966552184	0.000177614	573074
17:04.4	5435.41	5.49872E+13	23.4905	0.0234905	2.366965889	1.45359214	0.913373749	0.000168041	573076
22:06.9	5432.92	5.49872E+13	21.4453	0.0214453	2.365881565	1.327035164	1.038846401	0.000191213	573076
27:09.8	5432.225	5.61296E+13	21.2462	0.0212462	2.317431508	1.314714856	1.002716652	0.000184587	573076
32:12.8	5441.735	5.62443E+13	20.9859	0.0209859	2.316752932	1.298607492	1.01814544	0.000187099	573076
37:15.9	5442.59	5.62443E+13	21.144	0.021144	2.317116938	1.30839072	1.008726218	0.000185339	573078
42:18.6	5445.325	5.62443E+13	21.9166	0.0219166	2.318281331	1.356199208	0.962082123	0.00017668	573078
47:22.7	5448.005	5.62443E+13	22.5932	0.0225932	2.319422308	1.398067216	0.921355092	0.000169118	573078
52:27.1	5435.845	5.62443E+13	21.9119	0.0219119	2.314245335	1.355908372	0.958336963	0.0001763	573078
57:29.5	5438.98	5.62443E+13	21.9931	0.0219931	2.315771606	1.360933028	0.954838578	0.00017554	573078
02:32.3	5442.915	5.4783E+13	21.9219	0.0219219	2.379070537	1.356527172	1.022543365	0.000187867	573079
17:16.9	5436.25	5.58596E+13	23.6788	0.0236788	2.330359521	1.465244144	0.865115377	0.000159138	573082
22:19.1	5423.025	5.53693E+13	26.537	0.026537	2.345273013	1.64210956	0.703163453	0.000129663	573083
27:21.7	5420.795	5.55346E+13	24.0354	0.0240354	2.337331623	1.487310552	0.850021071	0.000156807	573083
32:24.2	5413.535	5.55346E+13	22.5862	0.0225862	2.334201266	1.397634056	0.93656721	0.000173005	573083
37:27.1	5430.01	5.52199E+13	28.4597	0.0284597	2.354647288	1.761086236	0.593561052	0.000109311	573085
42:29.6	5436.77	5.52199E+13	32.914	0.032914	2.357578667	2.03671832	0.320860347	5.90E-05	573085
47:32.1	5434.36	5.52199E+13	26.3515	0.0263515	2.356533605	1.63063082	0.725902785	0.000133576	573085
52:35.1	5435.69	5.52199E+13	26.7179	0.0267179	2.35711034	1.653303652	0.703806688	0.000129479	573085
57:37.9	5435.07	5.52199E+13	25.5393	0.0255393	2.356841486	1.580371884	0.776469602	0.000142863	573085
02:40.2	5435.165	5.40023E+13	22.1198	0.0221198	2.410024529	1.368773224	1.041251305	0.000191577	573086
07:42.9	5437.755	5.40023E+13	22.0131	0.0220131	2.41117297	1.362170628	1.049002342	0.000192911	573086
12:45.6	5439.425	5.40023E+13	22.4233	0.0224233	2.41191347	1.387553804	1.024359666	0.000188321	573086
17:57.1	5438.005	5.38957E+13	22.4054	0.0224054	2.416055965	1.386446152	1.029609813	0.000189336	573087
22:59.9	5438.005	5.36854E+13	22.5992	0.0225992	2.425520713	1.398438496	1.027082217	0.000188871	573088
28:02.4	5441.505	5.476E+13	23.024	0.023024	2.379449069	1.42472512	0.954723949	0.000175452	573089
33:27.3	5440.01	5.57711E+13	22.2373	0.0222373	2.335671095	1.376044124	0.959626971	0.000176402	573089
38:30.0	5438.99	5.57711E+13	22.1938	0.0221938	2.335233158	1.373352344	0.961880814	0.000176849	573091
43:33.9	5439.205	5.57873E+13	22.3417	0.0223417	2.334649265	1.382504396	0.952144869	0.000175052	573092
48:36.3	5438.38	5.57873E+13	22.2618	0.0222618	2.334295154	1.377560184	0.95673497	0.000175923	573092
53:38.7	5442.075	5.57873E+13	21.4256	0.0214256	2.335881144	1.325816128	1.010065016	0.000185603	573092

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
58:41.0	5443.865	5.53151E+13	22.2455	0.0222455	2.356594622	1.37655154	0.980043082	0.000180027	573093
03:43.6	5443.85	5.548E+13	21.6625	0.0216625	2.349581464	1.3404755	1.009105964	0.000185366	573092
09:13.8	5445.09	5.52777E+13	21.8393	0.0218393	2.358717699	1.351415884	1.007301815	0.000184993	573094
14:16.3	5439.75	5.53768E+13	21.8857	0.0218857	2.352187759	1.354287116	0.997900643	0.000183446	573096
19:18.9	5432.365	5.54331E+13	22.051	0.022051	2.346610835	1.36451588	0.982094955	0.000180786	573096
24:21.3	5429.395	5.54331E+13	22.0336	0.0220336	2.345327888	1.363439168	0.98188872	0.000180847	573098
29:24.2	5429.825	5.54331E+13	22.0994	0.0220994	2.345513635	1.367510872	0.978002763	0.000180117	573098
34:26.8	5425.685	5.54331E+13	22.1767	0.0221767	2.343725285	1.372294196	0.971431089	0.000179043	573098
39:29.4	5423.045	5.46805E+13	21.4414	0.0214414	2.374827207	1.326793832	1.048033375	0.000193256	573099
02:11.2	5440.505	5.46805E+13	21.1749	0.0211749	2.382473185	1.310302812	1.072170373	0.000197072	573099
07:13.5	5442.915	5.46805E+13	21.0826	0.0210826	2.383528557	1.304591288	1.078937269	0.000198228	573099
12:33.1	5450.445	5.29509E+13	20.737	0.020737	2.464789908	1.28320556	1.181584348	0.000216787	573099
23:02.0	5455.495	5.22504E+13	21.8746	0.0218746	2.500147189	1.353600248	1.146546941	0.000210164	573105
23:55.9	5456.87	5.22504E+13	21.8746	0.0218746	2.500777325	1.353600248	1.147177077	0.000210226	573105
28:58.5	5450.6	5.22504E+13	21.9128	0.0219128	2.497903906	1.355964064	1.141939842	0.000209507	573105
34:00.9	5450.995	5.07231E+13	21.5398	0.0215398	2.573306116	1.332882824	1.240423292	0.000227559	573106
14:22.2	5454.64	4.99585E+13	20.628	0.020628	2.614437674	1.27646064	1.337977034	0.000245292	573108
26:27.9	5442.795	4.99585E+13	19.4006	0.0194006	2.608760304	1.200509128	1.408251176	0.000258737	573108
26:47.7	5442.795	4.99585E+13	19.4006	0.0194006	2.608760304	1.200509128	1.408251176	0.000258737	573108
31:50.2	5437.615	4.87781E+13	19.3726	0.0193726	2.669344789	1.198776488	1.470568301	0.000270444	573110
41:54.8	5439.855	4.87781E+13	18.9891	0.0189891	2.670444413	1.175045508	1.495398905	0.000274897	573110
46:58.4	5435.995	4.87781E+13	18.9799	0.0189799	2.668549525	1.174476212	1.494073313	0.000274848	573110
52:01.0	5428.285	4.87781E+13	18.7294	0.0187294	2.664764659	1.158975272	1.505789387	0.000277397	573110
57:03.7	5425.005	4.87781E+13	18.6969	0.0186969	2.663154495	1.156964172	1.506190323	0.000277639	573110
02:06.3	5429.985	4.87781E+13	19.0331	0.0190331	2.665599195	1.177768228	1.487830967	0.000274003	573110
07:09.3	5419.32	4.87781E+13	18.8866	0.0188866	2.660363708	1.168702808	1.4916609	0.000275249	573110
12:11.9	5419.995	4.87781E+13	19.1336	0.0191336	2.660695068	1.183987168	1.4767079	0.000272456	573110
17:14.6	5424.35	4.87781E+13	19.08	0.01908	2.662832953	1.1806704	1.482162553	0.000273242	573110
22:17.3	5432.855	4.87781E+13	18.9641	0.0189641	2.667008088	1.173498508	1.49350958	0.000274903	573110
27:20.4	5440.75	4.77858E+13	18.6372	0.0186372	2.726348138	1.153269936	1.573078202	0.000289129	573113
32:23.3	5433.33	4.77858E+13	18.5334	0.0185334	2.722629992	1.146846792	1.5757832	0.000290022	573113
37:25.8	5425.145	4.78654E+13	18.6096	0.0186096	2.714005692	1.151562048	1.562443644	0.000288	573113
42:28.3	5426.5	4.78654E+13	18.5025	0.0185025	2.71468355	1.1449347	1.56974885	0.000289275	573113
47:31.7	5423.595	4.78654E+13	18.0283	0.0180283	2.713230283	1.115591204	1.597639079	0.000294572	573114
52:34.3	5433.83	4.73922E+13	17.9965	0.0179965	2.745491075	1.11362342	1.631867655	0.000300316	573115
57:37.2	5433.385	4.71846E+13	17.2396	0.0172396	2.757345391	1.066786448	1.690558943	0.000311143	573116
02:40.7	5439.995	4.71846E+13	16.5541	0.0165541	2.760699847	1.024367708	1.736332139	0.000319179	573116
07:43.8	5444.995	4.71846E+13	17.1154	0.0171154	2.763237257	1.059100952	1.704136305	0.000312973	573116
12:46.5	5445.535	4.68216E+13	17.0656	0.0170656	2.784936027	1.056019328	1.728916699	0.000317493	573116
17:49.5	5445.005	4.68216E+13	17.4931	0.0174931	2.784664976	1.082473028	1.702191948	0.000312615	573117
22:52.4	5433.015	4.80008E+13	17.4479	0.0174479	2.710274619	1.079676052	1.630598567	0.000300128	573119
27:55.3	5436.995	4.79243E+13	17.4408	0.0174408	2.716593944	1.079236704	1.63735724	0.000301151	573119
32:57.9	5439.965	4.75485E+13	17.4675	0.0174675	2.739560283	1.0808889	1.658671383	0.000304905	573119
38:00.3	5442.685	4.75485E+13	17.4015	0.0174015	2.740930072	1.07680482	1.664125252	0.000305754	573121
43:03.0	5440.005	4.75485E+13	17.17	0.01717	2.739580427	1.0624796	1.677100827	0.00030829	573121

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
48:05.5	5430.175	4.73628E+13	17.0847	0.0170847	2.745351909	1.057201236	1.688150673	0.000310883	573122
53:07.7	5429.175	4.73628E+13	16.7253	0.0167253	2.744846336	1.034961564	1.709884772	0.000314944	573122
58:10.0	5426.865	4.69236E+13	16.3435	0.0163435	2.769355552	1.01133578	1.758019772	0.000323948	573123
03:12.6	5429.085	4.67681E+13	13.8732	0.0138732	2.779699436	0.858473616	1.92122582	0.000353877	573124
08:15.1	5431.47	4.67681E+13	15.2382	0.0152382	2.78092056	0.942939816	1.837980744	0.000338395	573124
13:18.1	5424.885	4.65395E+13	15.2908	0.0152908	2.791196165	0.946194704	1.845001461	0.0003401	573125
18:20.9	5423.105	4.63931E+13	15.2056	0.0152056	2.799084598	0.940922528	1.85816207	0.000342638	573126
23:25.0	5428.995	4.63931E+13	14.084	0.014084	2.802124666	0.87151792	1.930606746	0.00035561	573126
28:27.8	5429.53	4.63931E+13	14.6377	0.0146377	2.802400801	0.905780876	1.896619925	0.000349316	573126
33:30.1	5421.765	4.63931E+13	14.7286	0.0147286	2.798392969	0.911405768	1.886987201	0.000348039	573126
38:33.9	5418.835	4.63931E+13	14.2071	0.0142071	2.796880677	0.879135348	1.917745329	0.000353904	573126
43:36.6	5419.985	4.69176E+13	15.9128	0.0159128	2.766201379	0.984684064	1.781517315	0.000328694	573126
48:39.0	5424.615	4.69176E+13	14.8951	0.0148951	2.768564395	0.921708788	1.846855607	0.000340458	573126
53:42.3	5427.6	4.69176E+13	15.4192	0.0154192	2.770087852	0.954140096	1.815947756	0.000334577	573127
58:44.9	5429.245	4.69176E+13	15.4136	0.0154136	2.770927411	0.953793568	1.817133843	0.000334694	573127
03:47.4	5428.005	4.60998E+13	15.0816	0.0150816	2.819436616	0.933249408	1.886187208	0.000347492	573128
08:49.8	5416.905	4.68042E+13	14.9353	0.0149353	2.771324127	0.924196364	1.847127763	0.000340993	573128
13:52.2	5418.215	4.68042E+13	15.6952	0.0156952	2.771994331	0.971218976	1.800775355	0.000332356	573128
18:54.9	5418.1	4.69135E+13	15.5699	0.0155699	2.765477064	0.963465412	1.802011652	0.000332591	573132
23:58.5	5414.42	4.69135E+13	15.4955	0.0154955	2.763598738	0.95886154	1.804737198	0.000333321	573130
29:01.2	5407.07	4.65547E+13	15.3382	0.0153382	2.781120585	0.949127816	1.831992769	0.000338814	573133
34:04.0	5411.13	4.65547E+13	14.8594	0.0148594	2.783208842	0.919499672	1.86370917	0.000344421	573133
39:07.1	5404.35	4.65362E+13	14.1832	0.0141832	2.780828165	0.877656416	1.903171749	0.000352156	573133
44:11.0	5402.605	4.65243E+13	14.313	0.014313	2.78064143	0.88568844	1.89495299	0.000350748	573133
49:13.7	5407.57	4.7068E+13	14.6216	0.0146216	2.75104653	0.904784608	1.846261922	0.000341422	573137
54:16.7	5404.085	4.7068E+13	14.499	0.014499	2.749273571	0.89719812	1.852075451	0.000342718	573136
59:19.2	5407.015	4.7068E+13	14.6389	0.0146389	2.750764179	0.905855132	1.844909047	0.000341207	573137
04:22.5	5401.14	4.7068E+13	14.5335	0.0145335	2.747775332	0.89933298	1.848442352	0.000342232	573137
09:25.0	5402.375	4.7068E+13	14.8172	0.0148172	2.748403626	0.916888336	1.83151529	0.00033902	573137
14:28.4	5402.39	4.7068E+13	10.4745	0.0104745	2.748411257	0.64816206	2.100249197	0.000388763	573137
19:31.1	5414.995	4.7068E+13	13.9344	0.0139344	2.754823923	0.862260672	1.892563251	0.000349504	573137
24:33.8	5418.94	4.7068E+13	14.4987	0.0144987	2.756830902	0.897179556	1.859651346	0.000343176	573137
29:36.6	5419.375	4.623E+13	14.1591	0.0141591	2.807027664	0.876165108	1.930862556	0.000356289	573137
34:39.6	5417.825	4.61707E+13	15.5092	0.0155092	2.809830269	0.959709296	1.850120973	0.000341488	573139
39:42.1	5417.825	4.61707E+13	15.4883	0.0154883	2.809830269	0.958416004	1.851414265	0.000341726	573140
44:45.0	5422.995	4.61707E+13	14.412	0.014412	2.81251157	0.89181456	1.92069701	0.000354176	573140
49:47.5	5427.095	4.61707E+13	14.1772	0.0141772	2.814637941	0.877285136	1.937352805	0.000356978	573140
54:50.8	5432.005	4.61707E+13	14.4201	0.0144201	2.817184399	0.892315788	1.924868611	0.000354357	573140
59:53.3	5430.485	4.94432E+13	14.5861	0.0145861	2.629983937	0.902587868	1.727396069	0.000318092	573142
04:55.7	5422.305	4.94432E+13	14.5598	0.0145598	2.626022363	0.900960424	1.725061939	0.000318142	573142
09:58.2	5418.115	4.96366E+13	15.3186	0.0153186	2.613770568	0.947914968	1.6658556	0.00030746	573143
15:01.1	5418.115	4.98376E+13	14.9214	0.0149214	2.60323101	0.923336232	1.679894778	0.000310052	573145
20:03.7	5418.005	4.96328E+13	14.8505	0.0148505	2.61391561	0.91894894	1.69496667	0.00031284	573143
25:06.6	5420.305	4.96328E+13	14.5132	0.0145132	2.615025245	0.898076816	1.716948429	0.000316762	573146
30:09.4	5426.325	4.94395E+13	14.1837	0.0141837	2.628167661	0.877687356	1.750480305	0.00032259	573146

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
35:12.1	5427.855	4.94395E+13	14.5006	0.0145006	2.628908696	0.897297128	1.731611568	0.000319023	573146
40:15.7	5430.415	4.94395E+13	14.5128	0.0145128	2.630148598	0.898052064	1.732096534	0.000318962	573147
45:18.2	5428.445	4.88866E+13	14.5128	0.0145128	2.65892821	0.898052064	1.760876146	0.000324379	573147
50:21.2	5426.235	4.88866E+13	14.8785	0.0148785	2.657845721	0.92068158	1.737164141	0.000320142	573149
55:24.0	5424.365	4.88866E+13	14.6008	0.0146008	2.656929769	0.903497504	1.753432265	0.000323251	573149
00:27.2	5427.36	4.88866E+13	15.3261	0.0153261	2.658396762	0.948379068	1.710017694	0.000315074	573149
05:29.6	5428.815	4.81462E+13	15.3334	0.0153334	2.700001105	0.948830792	1.751170313	0.00032257	573150
10:32.4	5421.935	4.81462E+13	15.6068	0.0156068	2.696579362	0.965748784	1.730830578	0.000319227	573150
15:35.0	5420.455	4.81462E+13	15.6068	0.0156068	2.69584329	0.965748784	1.730094506	0.000319179	573150
20:38.3	5417.11	4.81462E+13	15.5037	0.0155037	2.694179666	0.959368956	1.73481071	0.000320247	573150
25:40.9	5420.815	4.73991E+13	15.7994	0.0157994	2.738518709	0.977666872	1.760851837	0.000324832	573150
30:44.4	5394.205	4.73991E+13	15.7943	0.0157943	2.725075715	0.977351284	1.747724431	0.000324	573150
35:46.9	5410.005	4.92899E+13	17.2035	0.0172035	2.628215469	1.06455258	1.563662889	0.000289032	573151
40:49.7	5412.695	4.92899E+13	16.6783	0.0166783	2.629522288	1.032053204	1.597469084	0.000295134	573151
45:52.5	5410.435	4.92899E+13	16.6893	0.0166893	2.628424365	1.032733884	1.595690481	0.000294928	573152
50:55.1	5420.47	4.92899E+13	17.1597	0.0171597	2.633299433	1.061842236	1.571457197	0.000289912	573152
55:57.6	5423.035	4.97429E+13	16.4828	0.0164828	2.61055221	1.019955664	1.590596546	0.000293304	573152
01:00.9	5429.265	4.97429E+13	15.0247	0.0150247	2.613551221	0.929728436	1.683822785	0.000310138	573152
06:04.1	5431.425	4.97429E+13	14.8332	0.0148332	2.614591006	0.917878416	1.69671259	0.000312388	573154
11:06.6	5437.2	4.97429E+13	15.8818	0.0158818	2.617370988	0.982765784	1.634605204	0.000300634	573154
16:08.9	5439.45	4.89414E+13	16.4818	0.0164818	2.661335232	1.019893784	1.641441448	0.000301766	573155
21:12.0	5438.055	4.89414E+13	16.4762	0.0164762	2.66158965	1.019547256	1.642042394	0.000301848	573154
26:14.7	5446.305	4.89414E+13	16.3329	0.0163329	2.664689147	1.010679852	1.654009295	0.000303694	573155
31:17.4	5441.675	4.93293E+13	16.4496	0.0164496	2.641491841	1.017901248	1.623590593	0.000298362	573156
36:21.1	5445.825	4.93293E+13	16.425	0.016425	2.64350633	1.016379	1.62712733	0.000298784	573156
41:23.6	5442.705	4.93293E+13	16.7442	0.0167442	2.641991823	1.036131096	1.605860727	0.000295048	573156
46:26.3	5456.785	4.8781E+13	17.0574	0.0170574	2.67859579	1.055511912	1.623083878	0.000297443	573156
51:29.3	5457.245	4.93144E+13	16.979	0.016979	2.649847984	1.05066052	1.599187464	0.000293039	573158
56:33.4	5455.01	4.9551E+13	16.7395	0.0167395	2.636116917	1.03584026	1.600276657	0.000293359	573160
01:36.0	5459.995	5.02892E+13	16.5506	0.0165506	2.599795101	1.024151128	1.575643973	0.00028858	573161
06:38.3	5445.905	5.02892E+13	15.7079	0.0157079	2.5930861	0.972004852	1.621081248	0.00029767	573162
11:41.2	5445.005	5.02892E+13	16.0766	0.0160766	2.592657562	0.994820008	1.597837554	0.00029345	573162
16:43.6	5436.46	5.02892E+13	17.3766	0.0173766	2.588588831	1.075264008	1.513324823	0.000278366	573162
21:46.6	5440.005	5.06055E+13	16.6529	0.0166529	2.574085327	1.030481452	1.543603875	0.00028375	573162
26:49.0	5439.9	5.04449E+13	17.0836	0.0170836	2.582230675	1.057133168	1.525097507	0.000280354	573162
31:51.7	5442.625	5.04449E+13	17.2727	0.0172727	2.583524188	1.068834676	1.514689512	0.000278301	573165
36:54.2	5442.255	5.04449E+13	17.2232	0.0172232	2.583348555	1.065771616	1.517576939	0.000278851	573165
41:57.0	5448.285	5.01022E+13	17.6705	0.0176705	2.6039012	1.09345054	1.51045066	0.000277234	573166
47:00.0	5449.45	5.01022E+13	17.1055	0.0171055	2.604457989	1.05848834	1.545969649	0.000283693	573166
52:02.9	5459.98	5.01022E+13	17.1633	0.0171633	2.609490597	1.062065004	1.547425593	0.000283412	573166
57:06.6	5458.01	4.9536E+13	17.5243	0.0175243	2.638364941	1.084403684	1.553961257	0.000284712	573166
02:08.9	5468.995	4.94552E+13	17.7744	0.0177744	2.647994419	1.099879872	1.548114547	0.000283071	573166
07:11.7	5461.76	4.94552E+13	18.284	0.018284	2.644491355	1.13141392	1.513077435	0.000277031	573169
12:14.4	5458.245	4.91478E+13	18.5758	0.0185758	2.659314619	1.149470504	1.509844115	0.000276617	573169
17:17.4	5461.23	4.91478E+13	18.543	0.018543	2.660768943	1.14744084	1.513328103	0.000277104	573169

date_time	BTC_USD_price	BTC_network_hashrate	real_time_LMP_mwh	real_time_LMP_kwh	gross_profit_USD_5m	power_cost_USD_5m	net_profit_USD_5m	net_profit_BTC_5m	block_height
22:20.2	5461.885	4.91478E+13	17.2205	0.0172205	2.661088065	1.06560454	1.595483525	0.000292112	573170
27:22.7	5459.025	4.91478E+13	17.0299	0.0170299	2.661185508	1.053810212	1.607375296	0.000294279	573170
32:25.5	5461.945	4.88407E+13	16.202	0.016202	2.677853382	1.00257976	1.675273622	0.000306717	573171
37:28.0	5460.795	4.88407E+13	13.6682	0.0136682	2.677289567	0.845788216	1.831501351	0.000335391	573172
42:30.8	5456.855	4.88407E+13	9.1082	0.0091082	2.675357884	0.563615416	2.111742468	0.000386989	573172
47:33.9	5452.415	4.81696E+13	9.1136	0.0091136	2.710422661	0.563949568	2.146473093	0.000393674	573173
52:36.6	5463.33	4.7991E+13	8.9266	0.0089266	2.725956684	0.552378008	2.173578676	0.000397849	573174
57:39.6	5459.105	4.7991E+13	13.6096	0.0136096	2.723848598	0.842162048	1.88168655	0.000344688	573174
02:42.1	5457.705	4.75851E+13	13.6135	0.0136135	2.746378796	0.84240338	1.903975416	0.00034886	573174
07:45.5	5458.515	4.75851E+13	14.0666	0.0140666	2.746786397	0.870441208	1.876345189	0.000343746	573175
12:48.6	5453.155	4.76939E+13	15.2424	0.0152424	2.737828238	0.943199712	1.794628526	0.000329099	573177
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Re: Day-ahead vs. RTBM LMP biz requirements and data questions

From: Austin Storms <austin@bearbox.io>
To: Denis Labij <dlabij@glidepath.net>
Date: Fri, 26 Apr 2019 22:35:58 -0500

Denis,

Thank you for your response - it helps tremendously in my understanding of how these markets work. I was able to build a workaround to the portal access issues and fetch both the day-ahead LMP data and the 5-minute RTBM LMP data.

I'm working on putting some data models together and will be in touch when Ben and I have reviewed it.

Thanks again!

-Austin
Austin M. Storms
BearBox, LLC
611 O' Keefe Avenue
New Orleans, LA 70113
austin@bearbox.io

On Thu, Apr 25, 2019 at 10:17 AM Denis Labij <dlabij@glidepath.net> wrote:
\>
\> Austin,
\>
\>
\>
\> See comments below in red.
\>
\>
\>
\> Denis
\>
\>
\>
\> From: Austin Storms <austin@bearbox.io>
\> Sent: Thursday, April 25, 2019 12:17 AM
\> To: Denis Labij <dlabij@glidepath.net>; Mike Hoadley <mhoadley@glidepath.net>; Chris Vickery <cvickery@glidepath.net>
\> Cc: Ben Hakes <ben@paretoadvisors.com>
\> Subject: Day-ahead vs. RTBM LMP biz requirements and data questions
\>
\>
\>
\> Hey guys,
\>
\> I've been working on some code for the miner management system that integrates RTBM LMP profitability checks - but have a few questions regarding business requirements and available data feeds.
\>
\> From my understanding, the day-ahead LMP $/MWh is calculated based on forecast estimated demand and the RTBM LMP $/MWh fills the gap between the estimated demand in day-ahead market and actual demand in real-time... is this correct? Sort of. In most ISOs the day-ahead market clears offered and self-scheduled generation against bid and self-scheduled load. Since there can be deviation charges for being off of your day-ahead schedule, I suspect most market participants offer and bid near their forecasts, though there may sometimes be reasons not to. RTBM is based on what is actually happening (ex ante) or actually has happened (ex post) on the system.

TX149
BearBox v. Lancium
21-cv-00534

>
> The data modeling and system I've been building fetches RTBM LMP price and compares the profitability of selling load @ RTBM LMP vs. using the same load to mine Bitcoin, but I'm not exactly sure what the business requirements are - and I'm looking for a bit of guidance to build the model to show contrasted profitability. You would first want to calculate a break even power price. This will depend on the power efficiency of your units, and the expected revenue per Terra Hash. Let's say this number is estimated to be $30/MWh. You would either bid DA load at $30 (i.e. you receive a schedule to draw load if the DA LMP is less than $30) or you offer a block of generation equal to the capacity of your miner at $30 (i.e. you receive a schedule to deliver power if the DA LMP is greater than $30). You would then do the same thing in RT. That is, if the RT LMP is greater than $30, and you have a DA schedule, you will want to curtail the miner and offset your DA schedule by selling it into the RT instead (this happens automatically as a result of being off of your DA schedule). Similarly, if you have no DA schedule, and prices go below $30 in RT, you will want to turn your miner on. Settlements can get pretty complicated and may vary from one ISO to the next, but this is the general idea.
>
> The data feed I've been utilizing is from the SPP marketplace - see link here to the 5-minute RTBM (https://marketplace.spp.org/file-api/download/rtbm-lmp-by-location?path=%2FRTBM-LMP-SL-latestInterval.csv). The only problem with fetching the .csv file is that it's a bit finicky - is there another data feed that Glide Path uses to get RTBM LMP pricing at specific node location? There is, but you need to be a market participant with portal access to query it. There is also public access to hourly-average RT prices but, as far as I know, not 5-min prices SPP mentions an FTP server in some of their Feb '18 published documentation, but I've yet to successfully authenticate to that server. If this is part of the portal, you would need a market participant digital certificate with the appropriate permissions.
>
>
>
> As always, I appreciate your time, consideration, and helpful input!
>
>
>
> Thanks and talk soon,
>
>
>
> Austin
>
>
> Austin M. Storms
> BearBox, LLC
> 611 O' Keefe Avenue
> New Orleans, LA 70113
> austin@bearbox.io
>

BearBox 20' product details and supporting documentation

From: Austin Storms <austin@bearbox.io>
To: michael.mcnamara@lancium.com
Date: Thu, 09 May 2019 11:32:01 -0500
Attachments: BearBox Product Details Summary v1.pdf (708.12 kB); Permatron_Spec_Sheet.pdf (1.23 MB); CamFil_Spec_Sheet.pdf (379.28 kB); JandD_Spec_Sheet.pdf (2.11 MB); exelon4_modeling_05092019.xlsx (92.14 kB)

Hey Michael,

See attached for the 20' BearBox product details and some supporting docs. I've also attached some recent modeling data from one of the Exelon wind sites (based on publicly available marketplace data) - I can model for any pricing node you guys might be interested in reviewing.

Let me know if you have any questions!

Talk soon,

A

Austin M. Storms
BearBox, LLC
611 O' Keefe Avenue
New Orleans, LA 70113
austin@bearbox.io

TX157
BearBox v. Lancium
21-cv-00534

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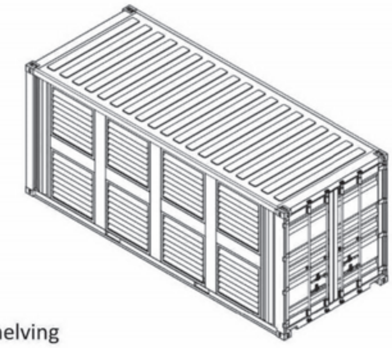
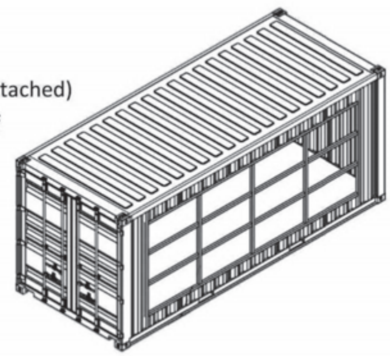
TX157.0001

BearBox

Product details - BearBox V20S (Bitmain S9j, Dragonmint T1, or similar)





- **Physical Dimensions**
  - Exterior: 20'L x 8' W x 8'6"H
  - Interior: 19'4"L x 7'8"W x 7'9"H
  - Door Opening: 7'8"W x 7'5"H
  - Weight: 4,900 lbs. + installed equipment
- **Electrical System**
  - 3-Phase, 4-Wire 415Y/240v
  - Remote dual-outlet control PDUs (64.8kW total)
  - All network infrastructure on UPS/battery backup
  - ~373kW max load
- **Physical Rack System**
  - Custom laser cut aluminum frame with stainless wire deck shelving
  - Adjustable in 1" increments
- **Cooling System**
  - Convection air cooled
  - (8) 10,100 CFM direct-drive, single-phase exhaust fans (see attached)
  - Temperature controlled/software automation, remote on/off
- **Air Filtration System**
  - Option 1: Permatron Model U2 (see attached)
  - Option 2: Camfil V-Bank Glide/Pack (see attached)
  - Intake-side adjustable pitch weather shield
- **Total Designed Hashrate**
  - 272 miners @ 14.5 TH/s each
  - 3.9 PH/s total
- **Network**
  - Cat5e ethernet
  - 48-port unmanaged switches (CISCO, TP-Link, or other)
  - On-site WAN or satellite (varies by location)
- **Software Management**
  - Local cgminer watchdog
  - PostgreSQL database miner logging
  - PDU/relay mapping (full automation)
  - Optional real-time breakeven monitoring (renewable marketplace data)
  - SMTP email alerts (restart, reboot, and maintenance required)
- **Summary**
  - BearBox V20S (3.9 PH/s @ ~373kW max load)
  - Does **NOT** include miners or exterior electrical infrastructure (transformer)
  - Price - $86,791.51 ($94,766.33 after 9.2% sales tax)

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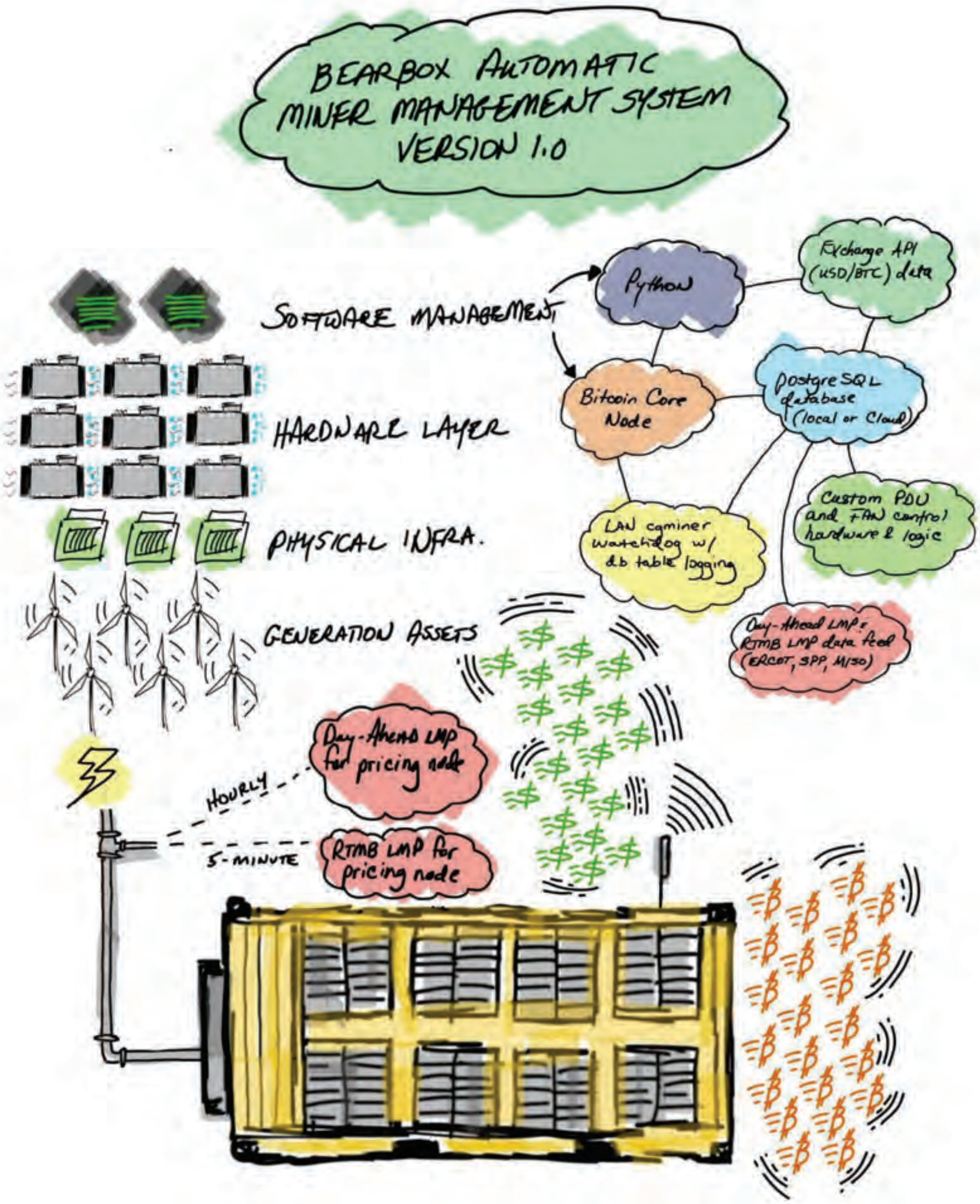
BearBox

Product details - BearBox V20S (Bitmain S9j, Dragonmint T1, or similar) – cont.



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TX157.0003

PERMATRON®

PreVent® Model U/BHA
Flexible Frame Air Intake Filter

MODEL #U1
MODEL #U2

Plastic mount clips available for easy installation.

Acts as a primary pre-filtration defense to help prevent the damage and extensive maintenance that large volumes of dirt and debris can cause. Model U and BHA are custom designed and manufactured to fit any sized air intake.

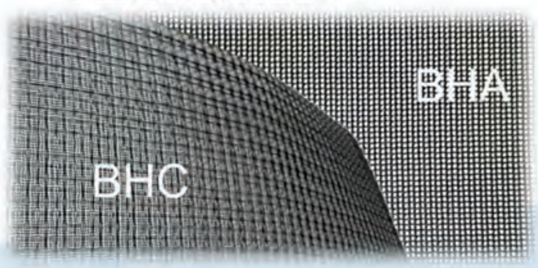
Model U filter is constructed of washable three-dimensional electrostatic polypropylene media and encased in a 1-1/4" sewn vinyl edge with single or double stitching. Model U1 contains one layer of media or Model U2 contains two layers of media depending on the application's environmental particle size.

Model BHA filter is constructed of black PVC coated polyester high abrasion media and encased in a 1-1/4" sewn vinyl edge with single or double stitching. Model BHA contains one layer of media.

- Can be affixed to unit with hook/loop stripping, grommets with mount clips, elastic bungee hooks or magnetic stripping
- Fits any equipment, specify size
- Sewn 2.5" vinyl edge (folded to 1-1/4") is standard for flexible filters 0-2000 square inches
- Sonic welded edges also available as frame option
- UV protected black media
- U/L Classified as to Flammability Only
- 5 Year Warranty

MODEL #BHA

Magnetic stripping inside vinyl edge available for easy installation.



	U1	U2	BHA
Avg. Arrestance Efficiency	42%	72%	N/A
Dust Holding Capacity	67 gm.	100 gm	N/A
Initial Air Flow Resistance	0.02" w.g.	0.05" w.g.	0.02" w.g.

www.permatron.com
1-800-882-8012

LIT-PREVENTMODELU/BHA

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TX157.0004

V-Bank Glide/Pack®

Advantages

- V-bank design reduces filter velocity and filter pressure drop by up to 60%, saving energy
- Increases life of filters up to four times

Typical applications: Single-stage V-bank filter housing for commercial, industrial, manufacturing or medical facilities.
Construction: 16-gauge galvanized steel with pre-drilled standing flanges, dual access doors, UV-resistant door knobs, door and filter sealing gasketing.
Filters: Any 2" deep filter.
Performance: Less than 1/2 of 1% leakage guaranteed. Rated airflow 500 fpm, may be operated to 625 fpm. Standard model operational to ± 6.0" w.g.
Additional data: Sizes available from 4 filters high to 6 filters wide. Housing is weatherproof for outside installation without modification. Includes pneumatic fitting for static pressure gauge.

See Literature 2421 for more details.

Dimensions and Airflow Capacity (cfm)

Number of filters wide	Height (inches)	½ Filter wide	1 Filter wide	1-½ Filters wide	2 Filters wide	2-½ Filters wide	3 Filters wide	3-½ Filters wide	4 Filters wide	4-½ Filters wide	5 Filters wide	5½ Filters wide	6 Filters wide	Housing depth (inches)
½	15.25	-	2,000	-	4,000	-	6,000	-	8,000	-	10,000	-	12,000	
1	27.25	2,000	4,000	6,000	8,000	10,000	12,000	14,000	16,000	18,000	20,000	22,000	24,000	
1-½	39.50	-	6,000	-	12,000	-	18,000	-	24,000	-	30,000	-	36,000	
2	51.50	4,000	8,000	12,000	16,000	20,000	24,000	28,000	32,000	36,000	40,000	44,000	48,000	28.00
2-½	63.75	-	10,000	-	20,000	-	30,000	-	40,000	-	50,000	-	60,000	
3	75.75	6,000	12,000	18,000	24,000	30,000	36,000	42,000	48,000	54,000	60,000	66,000	72,000	
3-½	88.00	-	14,000	-	28,000	-	42,000	-	54,000	-	70,000	-	84,000	
4	100.00	8,000	16,000	24,000	32,000	40,000	48,000	56,000	60,000	72,000	80,000	88,000	96,000	
	Width (inches)	12	24	36	48	60	72	84	96	108	120	132	144	

Conover NC, Corcoran CA, Crystal Lake IL, Riverdale NJ,
Washington NC, Concord Ontario
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(71) Applicant: **LANCIUM LLC** [US/US]; c/o Angelo Mikeska PLLC, 21 Waterway Avenue, Suite 300, The Woodlands, TX 77380 (US).

(72) Inventors: **HENSON, David;** Lancium LLC, c/o Angelo Mikeska PLLC, 21 Waterway Avenue, Suite 300, The Woodlands, TX 77380 (US). **MCNAMARA, Michael;** Lancium LLC, c/o Angelo Mikeska PLLC, 21 Waterway Avenue, Suite 300, The Woodlands, TX 77380 (US). **CLINE, Raymond;** Lancium LLC, c/o Angelo Mikeska PLLC, 21 Waterway Avenue, Suite 300, The Woodlands, TX 77380 (US).

(74) Agent: **KORENCHAN, James, L.;** McDonnell Boehnen Hulbert & Berghoff LLP, 300 South Wacker Drive, Suite 3200, Chicago, IL 60606 (US).

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(54) Title: METHOD AND SYSTEM FOR DYNAMIC POWER DELIVERY TO A FLEXIBLE DATACENTER USING UNUTILIZED ENERGY SOURCES

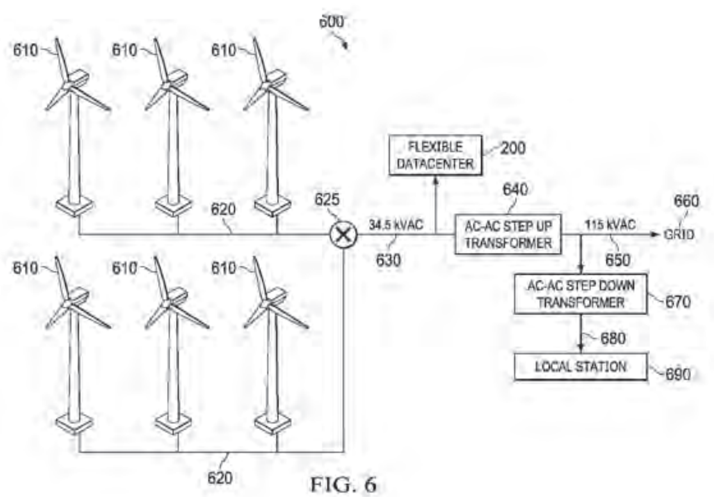

FIG. 6

WO 2019/139632 A1

(57) Abstract: A flexible datacenter includes a mobile container, a behind-the-meter power input system, a power distribution system, a datacenter control system, a plurality of computing systems, and a climate control system. The datacenter control system modulates power delivery to the plurality of computing systems based on unutilized behind-the-meter power availability or an operational directive. A method of dynamic power delivery to a flexible datacenter using unutilized behind-the-meter power includes monitoring unutilized behind-the-meter power availability, determining when a datacenter ramp-up condition is met, enabling behind-the-meter power delivery to one or more computing systems when the datacenter ramp-up condition is met, and directing the one or more computing systems to perform predetermined computational operations.

Bearbox v Lancium
Trial Exhibit
TX163

[Continued on next page]

WO 2019/139632 A1

MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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METHOD AND SYSTEM FOR DYNAMIC POWER DELIVERY TO A FLEXIBLE DATACENTER USING UNUTILIZED ENERGY SOURCES

BACKGROUND OF THE INVENTION

[0001] Blockchain technology was originally conceived of as an open and distributed system for securely conducting transactions with cryptographic currency. However, the foundational principle of blockchain technology is the ability to securely transact information of any type or kind between anonymous parties without intermediaries or a centralized trust authority. As such, blockchain technology finds application outside the realm of cryptocurrency and is widely considered one of the more robust and secure means of transacting information in the computer sciences.

[0002] In typical blockchain implementations, each participating party creates a digital identity, or wallet, which includes a pair of cryptographic keys used to transact information securely and anonymously with the blockchain. The blockchain may be thought of as a constantly growing database of all prior transaction information that is securely and coherently replicated across all nodes of a peer-to-peer blockchain network. The blockchain includes a sequence of blocks, where each block includes a bundle of transactions and other data including a hash of the prior block in the chain. As such, each block in the blockchain is mathematically related to the prior block, protecting the integrity of the blockchain from the most recently added block to the genesis block in the chain. Because anyone may participate in the curation of the blockchain, once a block is added, it becomes a permanent and immutable part of the blockchain. Thus, the blockchain stores transactions in a manner that prevents the transactions from being altered or otherwise corrupted, unless all subsequent blocks in the blockchain are also altered. The immutability of the blockchain makes the malicious alteration of a block exceptionally difficult, if not impossible, and at the very least makes it easy to detect and deter any such attempt before being accepted and replicated across the blockchain network.

[0003] Each transacting party of the blockchain uses a pair of cryptographic keys to anonymously transact information. The private key is a random number maintained in secrecy by the party holder that is used to derive a public key and sign information. The private key and the public key are mathematically related such that anyone holding the public key may verify that information signed with the private key originated from the holder of the private key. When an initiating party wishes to

transact information, the information is signed with the initiating party's private key and broadcast to the blockchain network. A biockchain miner uses the initiating party's public key to verify that the initiating party initiated, or signed, the transaction. Once the initiating party's signature is validated, the transaction is validated, added to the next block in the blockchain, and replicated across all nodes.

[0004] The computational overhead of the blockchain is largely due to hashing functions used by blockchain miners to discover new blocks. While computationally intensive, the work performed by miners is critically important to the functionality of the blockchain. When an initiating party's transaction request has been lodged and the signatures validated, the transaction request is pooled in the blockchain network. Blockchain miners validate transactions and compete to discover a new block to be added to the blockchain. In order to add a newly discovered block to the biockchain, the blockchain miner must provide a cryptographic proof of the discovered block. To create the proof, the miner inputs the hash value of the prior block in the blockchain, the candidate block to be added, and a random number, commonly referred to as the nonce, to a hash function. The hash function takes input of any length and outputs an alphanumeric string of fixed length, commonly referred to as a hash, which uniquely identifies the input. However, the blockchain algorithm requires that the hash start with a certain number of leading zeros as determined by the current level of prescribed difficulty. The blockchain network modulates the level of difficulty for block discovery, by varying the number of leading zeros required in the calculated hash, based on the amount of computing power in the blockchain network.

[0005] As more computational capacity has come online, the hash rate has increased dramatically. In an effort to keep the block discovery time constant, the blockchain network modulates difficulty every 2016 blocks discovered. If the blockchain network hash rate is too high and the amount of time taken to discover a new block is less than 10 minutes, the difficulty is increased proportionally to increase the block discovery time to 10 minutes. Similarly, if the blockchain hash rate is too low and the amount of time taken to discover a new block is more than 10 minutes, the difficulty is increased proportionally to reduce the block discovery time to 10 minutes. Because there is no way to predict what hash value a given set of input data will generate, miners often have to execute the hash function a substantial number of times, each time inputting a new nonce, to generate a new hash value.

When a miner is the first to obtain a hash value having the correct number of leading zeros, they broadcast the newly discovered block to the biockchain network and the biockchain is replicated across all nodes

BRIEF SUMMARY OF THE INVENTION

[0006] According to one aspect of one or more embodiments of the present invention, a flexible datacenter includes a mobile container, a **behind-the-meter** power input system, a power distribution system, a datacenter control system, a plurality of computing systems, and a climate control system. The datacenter control system modulates power delivery to the plurality of computing systems based on unutilized behind-the-meter power availability or an operational directive

[0007] According to one aspect of one or more embodiments of the present invention, a method of dynamic power delivery to a flexible datacenter using unutilized behind-the-meter power includes monitoring unutilized behind-the-meter power availability, determining **when** a datacenter ramp-up condition is met, enabling behind-the-meter power deliver}' to one or more computing systems when the datacenter ramp-up condition is met, and directing the one or more computing systems to perform predetermined computational operations.

[0008] Other aspects of the present invention **will** be apparent from the following description and claims

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Figure **1** shows a computing system **in** accordance with one or more embodiments of the present invention.

[0010] Figure 2 shows a flexible datacenter in accordance with one or more embodiments of the present invention.

[001 l] Figure 3 shows a three-phase power distribution of a flexible datacenter in accordance **with** one or more embodiments of the present invention

[0012] Figure 4 shows a control distribution scheme of a flexible datacenter in accordance with one or more embodiments of the present invention.

[0013] Figure 5 shows a control distribution scheme of a fleet of flexible datacenters in accordance with one or more embodiments of the present invention

[0014] Figure **6** show's a flexible datacenter **powered** by one or more wind turbines in accordance with one or more embodiments of the present invention.

[0015] Figure 7 shows a flexible datacenter powered by one or more solar panels in accordance with one or more embodiments of the present invention.

[0016] Figure 8 shows a flexible datacenter pow'ered by flare gas in accordance with one or more embodiments of the present invention.

[0017] Figure 9 shows a method of dynamic power delivery to a flexible datacenter using unutilized behind-the-meter power in accordance with one or more embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0018] One or more embodiments of the present invention are described in detail with reference to the accompanying figures. For consistency, like elements in the various figures are denoted by like reference numerals. In the following detailed description of the present invention, specific details are set forth in order to provide a thorough understanding of the present invention. In other instances, well-known features to one having ordinary skill in the art are not described to avoid obscuring the description of the present invention.

[0019] Blockchain miners are typically compensated for their efforts through either a discover}, fee or a fee paid by one or more of the transacting parties. Consequently, more and more computing resources are coming online to compete for these fees. As the number of computing resources increases, the blockchain network modulates the difficulty level, requiring hash values with more leading zeros. In essence, the increased difficulty means more hashing operations are required to find a valid hash. As such, there is an increasing number of computing resources executing an increasing number of hash functions that do not result in the discovery of a valid hash, yet still consume a substantial amount of power.

[0020] The intensive computational demand of blockchain applications makes the widespread adoption of blockchain technology ineffi cient and unsustainable from an energy and environmental perspective. In certain blockchain applications, with limited participation, roughly 5 quintillion 256-bit cryptographic hashes are created each and every' second of every day. While it is difficult to determine how much energy is required for that computational task, it is estimated to be in excess of 500 megawatts, the vast majority of which is sourced from fossil fuels. The majority of blockchain mining operations are currently being conducted in the People's Republic of China and powered by coal-fired energy. As blockchain technology

proliferates, there is concern that the energy required to sustain such blockchain applications could exceed that of a developed country.

[0021] While future versions of blockchain technology may improve power consumption for various blockchain operations, including hashing functions, industry' efforts have focused on the development of central processing units ("CPUs"), graphics processing units ("GPUs"), and application specific integrated circuits ("ASICs") that are specifically designed to perform blockchain operations in a more efficient manner. While such efforts are beneficial, the issue remains, the widespread adoption of blockchain technology will require substantially more pow er than is economically and environmentally feasible.

[0022] Accordingly, in one or more embodiments of the present invention, a method and system for dynamic power delivery' to a flexible datacenter uses unutilized behind-the-meter power sources without transmission and distribution costs. The flexible datacenter may be configured to modulate power delivery to one or more computing systems based on the availability of unutilized behind-the-meter power or an operational directive. For example, the flexible datacenter may ramp-up to a fully online status, ramp-down to a fully offline status, or dynamically reduce power consumption, act a load balancer, or adjust the power factor. Advantageously, the flexible datacenter may perform computational operations, such as blockchain hashing operations, with little to no energy costs, using clean and renewable energy that would otherwise be wasted.

[0023] Figure 1 shows a computing system 100 in accordance with one or more embodiments of the present invention. Computing system 100 may include one or more central processing units (singular "CPU" or plural "CPUs") 105, host bridge 110, input/output ("IO") bridge 115, graphics processing units (singular "GPU" or plural "GPUs") 125, and/or application-specific integrated circuits (singular "ASIC or plural "ASICs") (not shown) disposed on one or more printed circuit boards (not shown) that are configured to perform computational operations. Each of the one or more CPUs 105, GPUs 125, or ASICs (not shown) may be a single-core (not independently illustrated) device or a multi-core (not independently illustrated) device. Multi-core devices typically include a plurality of cores (not shown) disposed on the same physical die (not shown) or a plurality of cores (not shown) disposed on multiple die (not shown) that are collectively disposed within the same mechanical package (not shown).

[0024] CPU 105 may be a general purpose computational device typically configured to execute software instructions. CPU 105 may include an interface 108 to host bridge **110**, an interface **118** to system memory 120, and an interface 123 to one or more IO devices, such as, for example, one or more GPUs 125. GPU 125 may serve as a specialized computational device typically configured to perform graphics functions related to frame buffer manipulation. However, one of ordinary skill in the art will recognize that GPU 125 may be used to perform non-graphics related functions that are computationally intensive. In certain embodiments, GPU 125 may interface 123 directly with CPU 125 (and interface **118** with system memory 120 through CPU 105). In other embodiments, GPU 125 may interface 121 with host bridge 110 (and interlace **116** or 118 with system memory 120 through host bridge **110** or CPU 105 depending on the application or design). In still other embodiments, GPU 125 may interface 133 with IO bridge 115 (and interface 116 or **118** with system memory 120 through host bridge **110** or CPU 105 depending on the application or design). The functionality of GPU 125 may be integrated, in whole or in part, with CPU 105.

[0025] Host bridge 110 may be an interface device configured to interface between the one or more computational devices and IO bridge 115 and, in some embodiments, system memory 120. Host bridge 110 may include an interface 108 to CPU 105, an interface 113 to IO bridge 115, for embodiments where CPU 105 does not include an interface **118** to system memory 120, an interface **116** to system memory 120, and for embodiments where CPU 105 does not include an integrated GPU 125 or an interface 123 to GPU 125, an interface 121 to GPU 125. The functionality of host bridge 110 may be integrated, in whole or in part, with CPU 105 IO bridge 115 may be an interface device configured to interface between the one or more computational devices and various IO devices (*e.g.,* 140, 145) and IO expansion, or add-on, devices (not independently illustrated). IO bridge 115 may include an interface 113 to host bridge 110, one or more interfaces 133 to one or more IO expansion devices 135, an interface 138 to keyboard 140, an interface 143 to mouse 145, an interface 148 to one or more local storage devices 150, and an interface 153 to one or more network interface devices 155. The functionality of IO bridge 115 may be integrated, in whole or in part, with CPU 105 or host bridge 110. Each local storage device 150, if any, may be a solid-state memory device, a solid-state memory device array, a hard disk drive, a hard disk drive array, or any other

non-transitory computer readable medium. Network interface device 155 may provide one or more network interfaces including any network protocol suitable to facilitate networked communications.

[0026] Computing system 100 may include one or more network-attached storage devices 160 in addition to, or instead of, one or more local storage devices 150. Each network-attached storage device 160, if any, may be a solid-state memory device, a solid-state memory device array, a hard disk drive, a hard disk drive array, or any other non-transitory computer readable medium. Network-attached storage device 160 may or may not be collocated with computing system 100 and may be accessible to computing system 100 via one or more network interfaces provided by one or more network interface devices 155.

[0027] One of ordinary skill in the art will recognize that computing system 100 may be a conventional computing system or an application-specific computing system. In certain embodiments, an application-specific computing system may include one or more ASICs (not shown) that are configured to perform one or more functions, such as hashing, in a more efficient manner. The one or more ASICs (not shown) may interface directly with CPU 105, host bridge 110, or GPU 125 or interface through IO bridge 115. Alternatively, in other embodiments, an application-specific computing system may be reduced to only those components necessary to perform a desired function in an effort to reduce one or more of chip count, printed circuit board footprint, thermal design power, and pow'er consumption. The one or more ASICs (not showm) may be used instead of one or more of CPU 105, host bridge 110, IO bridge 115, or GPU 125 In such systems, the one or more ASICs may incorporate sufficient functionality to perform certain network and computational functions in a minimal footprint with substantially fewer component devices.

[0028] As such, one of ordinary skill in the art will recognize that CPU 105, host bridge 110, IO bridge 115, GPU 125, or ASIC (not shown) or a subset, superset, or combination of functions or features thereof, may be integrated, distributed, or excluded, in whole or in part, based on an application, design, or form factor in accordance with one or more embodiments of the present invention. Thus, the description of computing system 100 is merely exemplary and not intended to limit the type, kind, or configuration of component devices that constitute a computing system 100 suitable for performing computing operations in accordance with one or more embodiments of the present invention.

[0029] One of ordinary skill in the art will recognize that computing system 100 may be a stand alone, laptop, desktop, server, blade, or rack mountable system and may vary based on an application or design.

[0030] Figure **2** shows a flexible datacenter 200 in accordance with one or more embodiments of the present invention. Flexible datacenter 200 may include a mobile container 205, a behind-the-meter power input system 210, a power distribution system **215,** a climate control system *(e.g.,* 250, 260, 270, 280, and/or 290), a datacenter control system 220, and a plurality of computing systems 100 disposed in one or more racks 240. Datacenter control system 220 may be a computing system *(e.g.,* 100 of Figure 1) configured to dynamically modulate power delivery to one or more computing systems 100 disposed within flexible datacenter 200 based on unutilized behind-the-meter power availability or an operational directive from a local station control system (not shown), a remote master control system (not shown), or a grid operator (not shown).

[0031] In certain embodiments, mobile container 205 may be a storage trailer disposed on wheels and configured for rapid deployment. In other embodiments, mobile container 205 may be a storage container (not shown) configured for placement on the ground and potentially stacked in a vertical manner (not shown). In still other embodiments, mobile container 205 may be an inflatable container, a floating container, or any other type or kind of container suitable for housing a mobile datacenter 200.

[0032] Flexible datacenter 200 may be rapidly deployed on site near a source of unutilized behind-the-meter power generation Behind-the-meter power input system 210 may be configured to input power to flexible datacenter 200. Behind-the-meter power input system 210 may include a first input (not independently illustrated) configured to receive three-phase behind-the-meter alternating current ("AC") voltage. In certain embodiments, behind-the-meter power input system 210 may include a supervisory AC-to-AC step-down transformer (not shown) configured to step down three-phase behind-the-meter AC voltage to single-phase supervisory nominal AC voltage or a second input (not independently illustrated) configured to receive single-phase supervisory nominal AC voltage from the local station (not shown) or a metered source (not shown). Behind-the-meter power input system 210 may provide single-phase supervisory nominal AC voltage to datacenter control system 220, which may remain powered at almost all times to control the

operation of flexible datacenter 200. The first input (not independently illustrated) or a third input (not independently illustrated) of behind-the-meter power input system 210 may direct three-phase behind-the-meter AC voltage to an operational AC-to-AC step-down transformer (not shown) configured to controllably step down three-phase behind-the-meter AC voltage to three-phase nominal AC voltage. Datacenter control system 220 may controllably enable or disable generation or provision of three-phase nominal AC voltage by the operational AC-to-AC step-down transformer (not shown).

[0033] Behind-the-meter power input system 210 may provide three phases of three-phase nominal AC voltage to power distribution system 215. Power distribution system 215 may controllably provide a single phase of three-phase nominal AC voltage to each computing system 100 or group 240 of computing systems **100** disposed within flexible datacenter 200. Datacenter control system 220 may controllably select which phase of three-phase nominal AC voltage that power distribution system 215 provides to each computing system 100 or group 240 of computing systems 100 In this way, datacenter control system 220 may modulate power delivery by either ramping-up flexible datacenter 200 to fully operational status, ramping-down flexible datacenter 200 to offline status (where only datacenter control system 220 remains powered), reducing power consumption by withdrawing power delivery from, or reducing power to, one or more computing systems 100 or groups 240 of computing systems 100, or modulating a power factor correction factor for the local station by controllably adjusting which phases of three-phase nominal AC voltage are used by one or more computing systems 100 or groups 240 of computing systems 100.

[0034] Flexible datacenter 200 may include a climate control system *(e.g,* 250, 260, 270, 280, 290) configured to maintain the plurality of computing systems 100 within their operational temperature range. In certain embodiments, the climate control system may include an air intake 250, an evaporative cooling system 270, a fan 280, and an air outtake 260. In other embodiments, the climate control system may include an air intake 250, an air conditioner or refrigerant cooling system 290, and an air outtake 260. In still other embodiments, the climate control system may include a computer room air conditioner system (not shown), a computer room air handler system (not shown), or an immersive cooling system (not shown). One of ordinary skill in the art will recognize that any suitable heat extraction system (not

shown) configured to maintain the operation of the plurality of computing systems 100 within their operational temperature range may be used in accordance with one or more embodiments of the present invention.

[0035] Flexible datacenter 200 may include a battery' system (not shown) configured to convert three-phase nominal AC voltage to nominal DC voltage and store power in a plurality of storage ceils. The battery, system (not shown) may include a DC-to-AC inverter configured to convert nominal DC voltage to three-phase nominal AC voltage for flexible datacenter 200 use. Alternatively, the battery system (not shown) may include a DC-to-AC inverter configured to convert nominal DC voltage to single-phase nominal AC voltage to power datacenter control system 220.

[0036] One of ordinary, skill in the art will recognize that a voltage level of three-phase behind-the-meter AC voltage may vary based on an application or design and the type or kind of local power generation. As such, a type, kind, or configuration of the operational AC-to-AC step down transformer (not shown) may vary based on the application or design. In addition, the frequency and voltage level of three-phase nominal AC voltage, single-phase nominal AC voltage, and nominal DC voltage may vary based on the application or design in accordance with one or more embodiments of the present invention.

[0037] Figure 3 shows a three-phase power distribution of a flexible datacenter 200 in accordance with one or more embodiments of the present invention. Flexible datacenter 200 may include a plurality of racks 240, each of which may include one or more computing systems 100 disposed therein. As discussed above, the behind-the-meter pow'er input system (210 of Figure 2) may provide three phases of three-phase nominal AC voltage to the power distribution system (215 of Figure 2). The power distribution system (215 of Figure 2) may controllably provide a single phase of three-phase nominal AC voltage to each computing system 100 or group 240 of computing systems 100 disposed within flexible datacenter 200. For example, a flexible datacenter 200 may include eighteen racks 240, each of which may include eighteen computing systems 100. The power distribution system (215 of Figure 2) may control which phase of three-phase nominal AC voltage is provided to one or more computing systems 100, a rack 240 of computing systems 100, or a group *(e.g.,* 310, 320, or 330) of racks 240 of computing systems 100.

[0038] In the figure, for purposes of illustration only, eighteen racks 240 are divided into a first group of six racks 310, a second group of six racks 320, and a third group

of six racks 330, where each rack contains eighteen computing systems 100. The power distribution system (215 of Figure 2) may, for example, provide a first phase of three-phase nominal AC voltage to the first group of six racks 310, a second phase of three-phase nominal AC voltage to the second group of six racks 320, and a third phase of three-phase nominal AC voltage to the third group of six racks 330. If the flexible datacenter (200 of Figure **2**) receives an operational directive from the local station (not shown) to provide power factor correction, the datacenter control system (220 of Figure 2) may direct the pow'er distribution system (215 of Figure 2) to adjust which phase or phases of three-phase nominal AC voltage are used to provide the power factor correction required by the local station (not shown) or grid operator (not shown). One of ordinary skill in the art will recognize that, in addition to the power distribution, the load may be varied by adjusting the number of computing systems 100 operatively powered. As such, the flexible datacenter (200 of Figure 2) may be configured to act as a capacitive or inductive load to provide the appropriate reactance necessary to achieve the power factor correction required by the local station (not shown).

[0039] Figure 4 show's a control distribution scheme of a flexible datacenter 200 in accordance with one or more embodiments of the present invention. Datacenter control system 220 may independently, or cooperatively with one or more of local station control system 410, remote master control system 420, and grid operator 440, modulate power delivery to flexible datacenter 200. Specifically, power delivery' may be dynamically adjusted based on conditions or operational directives.

[0040] Local station control system 410 may be a computing system *(e.g,* 100 of Figure 1) that is configured to control various aspects of the local station (not independently illustrated) that generates power and sometimes generates unutilized behind-the-meter power. Local station control system 410 may communicate with remote master control system 420 over a networked connection 430 and with datacenter control system 220 over a networked or hardwired connection 415. Remote master control system 420 may be a computing system *(e.g.,* 100 of Figure 1) that is located offsite, but connected via a network connection 425 to datacenter control system 220, that is configured to provide supervisory or override control of flexible datacenter 200 or a fleet (not shown) of flexible datacenters 200. Grid operator 440 may be a computing system *(e.g,* 100 of Figure 1) that is configured to control various aspects of the grid (not independently illustrated) that receives

power from the local station (not independently illustrated). Grid operator 440 may communicate with local station control system 440 over a networked or hardwired connection 445.

[0041] Datacenter control system 220 may monitor unutilized behind-the-meter power availability at the local station (not independently illustrated) and determine when a datacenter ramp-up condition is met. Unutilized behind-the-meter power availability may include one or more of excess local power generation, excess local power generation that the grid cannot accept, local power generation that is subject to economic curtailment, local power generation that is subject to reliability curtailment, local power generation that is subject to power factor correction, situations where local power generation is prohibitively low, start up situations, transient situations, or testing situations where there is an economic advantage to using locally generated behind-the-meter power generation, specifically power available at little to no cost and with no associated transmission or distribution costs.

[0042] The datacenter ramp-up condition may he met if there is sufficient behind-the-meter power availability and there is no operational directive from local station control system 410, remote master control system 420, or grid operator 440 to go offline or reduce power. As such, datacenter control system 220 may enable 435 behind-the-meter power input system 210 to provide three-phase nominal AC voltage to the power distribution system (215 of Figure 2) to power the plurality of computing systems (100 of Figure 2) or a subset thereof. Datacenter control system 220 may optionally direct one or more computing systems (**100** of Figure 2) to perform predetermined computational operations. For example, if the one or more computing systems (**100** of Figure 2) are configured to perform blockchain hashing operations, datacenter control system 220 may direct them to perform blockchain hashing operations for a specific blockchain application, such as, for example, Bitcoin, Litecoin, or Ethereum. Alternatively, one or more computing systems (100 of Figure 2) may be configured to independently receive a computational directive from a network connection (not shown) to a peer-to-peer blockchain network (not shown) such as, for example, a network for a specific blockchain application, to perform predetermined computational operations.

[0043] Remote master control system 420 may specify to datacenter control system 220 what sufficient behind-the-meter power availability constitutes, or datacenter

control system 220 may be programmed with a predetermined preference or criteria on which to make the determination independently. For example, in certain circumstances, sufficient behind-the-meter power availability may be less than that required to fully power the entire flexible datacenter 200. In such circumstances, datacenter control system 220 may provide power to only a subset of computing systems (100 of Figure 2), or operate the plurality of computing systems (100 of Figure 2) in a lower power mode, that is within the sufficient, but less than full, range of power that is available.

[0044] While flexible datacenter 200 is online and operational, a datacenter ramp-down condition may be met when there is insufficient, or anticipated to be insufficient, behind-the-meter power availability or there is an operational directive from local station control system **410,** remote master control system 420, or grid operator 440. Datacenter control system 220 may monitor and determine when there is insufficient, or anticipated to be insufficient, behind-the-meter power availability. As noted above, sufficiency may be specified by remote master control system 420 or datacenter control system 220 may be programmed with a predetermined preference or criteria on which to make the determination independently. An operational directive may be based on current dispatchability, forward looking forecasts for when unutilized behind-the-meter power is, or is expected to be, available, economic considerations, reliability considerations, operational considerations, or the discretion of the local station 410, remote master control 420, or grid operator 440. For example, local station control system 410, remote master control system 420, or grid operator 440 may issue an operational directive to flexible datacenter 200 to go offline and power down. When the datacenter ramp-down condition is met, datacenter control system 220 may disable pow'er delivery to the plurality of computing systems (100 of Figure 2). Datacenter control system 220 may disable 435 behind-the-meter power input system 210 from providing three-phase nominal AC voltage to the power distribution system (215 of Figure 2) to pow er down the plurality of computing systems (100 of Figure 2), while datacenter control system 220 remains powered and is capable of rebooting flexible datacenter 200 when unutilized behind-the-meter power becomes available again.

[0045] While flexible datacenter 200 is online and operational, changed conditions or an operational directive may cause datacenter control system 220 to modulate pow er consumption by flexible datacenter 200 Datacenter control system 220 may

determine, or local station control system 410, remote master control system 420, or grid operator 440 may communicate, that a change in local conditions may result in less power generation, availability, or economic feasibility, than would be necessary to fully power flexible datacenter 200. In such situations, datacenter control system 220 may take steps to reduce or stop power consumption by flexible datacenter 200 (other than that required to maintain operation of datacenter control system 220). Alternatively, local station control system 410, remote master control system 420, or grid operator 440, may issue an operational directive to reduce power consumption for any reason, the cause of which may be unknown. In response, datacenter control system 220 may dynamically reduce or withdraw power delivery to one or more computing systems (100 of Figure 2) to meet the dictate. Datacenter control system 220 may controllably provide three-phase nominal AC voltage to a smaller subset of computing systems (100 of Figure 2) to reduce power consumption. Datacenter control system 220 may dynamically reduce the power consumption of one or more computing systems (100 of Figure 2) by reducing their operating frequency or forcing them into a lower power mode through a network directive.

[0046] One of ordinary skill in the art will recognize that datacenter control system 220 may be configured to have a number of different configurations, such as a number or type or kind of computing systems (100 of Figure 2) that may be powered, and in what operating mode, that correspond to a number of different ranges of sufficient and available unutilized behind-the-meter power availability. As such, datacenter control system 220 may modulate power delivery over a variety of ranges of sufficient and available unutilized behind-the-meter power availability.

[0047] Figure 5 shows a control distribution of a fleet 500 of flexible datacenters 200 in accordance with one or more embodiments of the present invention. The control distribution of a flexible datacenter 200 shown and described with respect to Figure 4 may be extended to a fleet 500 of flexible datacenters 200. For example, a first local station (not independently illustrated), such as, for example, a wind farm (not shown), may include a first plurality 510 of flexible datacenters 200« through 200*d*, which may be collocated or distributed across the local station (not shown). A second local station (not independently illustrated), such as, for example, another wind farm or a solar farm (not shown), may include a second plurality 520 of flexible datacenters 200e through 200/y which may he collocated or distributed

across the local station (not shown). One of ordinary skill in the art will recognize that the number of flexible datacenters 200 deployed at a given station and the number of stations within the fleet may vary based on an application or design in accordance with one or more embodiments of the present invention.

[0048] Remote master control system 420 may provide supervisory control over fleet 500 of flexible datacenters 200 in a similar manner to that shown and described with respect to Figure 4, with the added flexibility to make high level decisions with respect to fleet 500 that may be counterintuitive to a given station. Remote master control system 420 may make decisions regarding the issuance of operational directives to a given local station based on, for example, the status of each local station where flexible datacenters 200 are deployed, the workload distributed across fleet 500, and the expected computational demand required for the expected workload. In addition, remote master control system 420 may shift workloads from a first plurality **510** of flexible datacenters 200 to a second plurality 520 of flexible datacenters 200 for any reason, including, for example, a loss of unutilized behind-the-meter pow'er availability at one local station and the availability of unutilized behind-the-meter power at another local station.

[0049] Figure 6 shows a flexible datacenter 200 powered by one or more wind turbines 610 in accordance with one or more embodiments of the present invention. A wind farm 600 typically includes a plurality of wind turbines 610, each of which intermittently generates a wind-generated AC voltage. The wind-generated AC voltage may vary based on a type, kind, or configuration of farm 600, turbine 610, and incident wind speed. The wind-generated AC voltage is typically input into a turbine AC-to-AC step-up transformer (not shown) that is disposed within the nacelle (not independently illustrated) or at the base of the mast (not independently illustrated) of turbine 610. The turbine AC-to-AC step up transformer (not shown) outputs three-phase wind-generated AC voltage 620. Three-phase wind-generated AC voltage 620 produced by the plurality of wind turbines 610 is collected 625 and provided 630 to another AC-to-AC step-up transformer 640 that steps up three-phase wind-generated AC voltage 620 to three-phase grid AC voltage 650 suitable for deliver}, to grid 660. Three-phase grid AC voltage 650 may be stepped down with an AC-to-AC step-down transformer 670 configured to produce three-phase local station AC voltage 680 provided to local station 690. One of ordinary skill in the art will recognize that the actual voltage levels may vary based on the type, kind,

or number of wind turbines 610, the configuration or design of wind farm 600, and grid 660 that it feeds into.

[0050] The output side of AC-to-AC step-up transformer 640 that connects to grid 660 may be metered and is typically subject to transmission and distribution costs. In contrast, power consumed on the input side of AC-to-AC step-up transformer 640 may be considered behind-the-meter and is typically not subject to transmission and distribution costs. As such, one or more flexible datacenters 200 may be powered by three-phase wind-generated AC voltage 620. Specifically, in wind farm 600 applications, the three-phase behind-the-meter AC voltage used to power flexible datacenter 200 may be three-phase wind-generated AC voltage 620. As such, flexible datacenter 200 may reside behind-the-meter, avoid transmission and distribution costs, and may be dynamically powered when unutilized behind-the-meter power is available.

[0051] Unutilized behind-the-meter pow'er availability may occur when there is excess local power generation. In high wind conditions, wind farm 600 may generate more power than, for example, AC-to-AC step-up transformer 640 is rated for. In such situations, wind farm 600 may have to take steps to protect its equipment from damage, which may include taking one or more turbines 610 offline or shunting their voltage to dummy loads or ground. Advantageously, one or more flexible datacenters 200 may be used to consume power on the input side of AC-to-AC step-up transformer 640, thereby allowing wind farm 600 to operate equipment within operating ranges while flexible datacenter 200 receives behind-the-meter power without transmission or distribution costs. The local station control system (not independently illustrated) of local station 690 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenters 200, the remote mater control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0052] Another example of unutilized behind-the-meter power availability is when grid 660 cannot, for whatever reason, take the power being produced by wind farm 600. In such situations, wind farm 600 may have to take one or more turbines 610 offline or shunt their voltage to dummy loads or ground. Advantageously, one or

more flexible datacenters 200 may be used to consume power on the input side of AC-to-AC step-up transformer 640, thereby allowing wind farm 600 to either produce pow'er to grid 660 at a lower level or shut down transformer 640 entirely while flexible datacenter 200 receives behind-the-meter power without transmission or distribution costs. The local station control system (not independently illustrated) of local station 690 or the grid operator (not independently illustrated) of grid 660 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenters 200, the remote master control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0053] Another example of unutilized behind-the-meter power availability is when wind farm 600 is selling power to grid 660 at a negative price that is offset by a production tax credit. In certain circumstances, the value of the production tax credit may exceed the price wind farm 600 would have to pay to grid 660 to offload their generated power. Advantageously, one or more flexible datacenters 200 may be used to consume power behind-the-meter, thereby allowing wind farm 600 to produce and obtain the production tax credit, but sell less power to grid 660 at the negative price. The local station control system (not independently illustrated) of local station 690 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenter 200, the remote master control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0054] Another example of unutilized behind-the-meter power availability is when wind farm 600 is selling power to grid 660 at a negative price because grid 660 is oversupplied or is instructed to stand down and stop producing altogether. The grid operator (not independently illustrated) may select certain power generation stations to go offline and stop producing power to grid 660. Advantageously, one or more flexible datacenters 200 may be used to consume power behind-the-meter, thereby

allowing wind farm 600 to stop producing power to grid 660, but making productive use of the power generated behind-the-meter without transmission or distribution costs. The local station control system (not independently illustrated) of the local station 690 or the grid operator (not independently illustrated) of grid 660 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenters 200, the remote master control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0055] Another example of unutilized behind-the-meter power availability is when wind farm 600 is producing power to grid 660 that is unstable, out of phase, or at the wrong frequency, or grid 660 is already unstable, out of phase, or at the wrong frequency for whatever reason. The grid operator (not independently illustrated) may select certain power generation stations to go offline and stop producing power to grid 660. Advantageously, one or more flexible datacenters 200 may be used to consume power behind-the-meter, thereby allowing wind farm 600 to stop producing power to grid 660, but make productive use of the power generated behind-the-meter without transmission or distribution costs. The local station control system (not independently illustrated) of local station 690 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenters 200, the remote master control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0056] Further examples of unutilized behind-the-meter power availability is when wind farm 600 experiences low wind conditions that make it not economically feasible to power up certain components, such as, for example, the local station (not independently illustrated), but there may be sufficient behind-the-meter power availability to power one or more flexible datacenters 200. Similarly, unutilized behind-the-meter power availability may occur when wind farm 600 is starting up,

or testing, one or more turbines 610. Turbines 610 are frequently offline for installation, maintenance, and sendee and must be tested prior to coming online as part of the array. One or more flexible datacenters 200 may be powered by one or more turbines 610 that are offline from farm 600. The above-noted examples of when unutilized behind-the-meter power is available are merely exemplary and are not intended to limit the scope of what one of ordinary skill in the art would recognize as unutilized behind-the-meter power availability. Unutilized behind-the-meter power availability may occur anytime there is power available and accessible behind-the-meter that is not subject to transmission and distribution costs and there is an economic advantage to using it.

[0057] One of ordinary skill in the art will recognize that wind farm 600 and wind turbine 610 may vary based on an application or design in accordance with one or more embodiments of the present invention.

[0058] Figure 7 shows a flexible datacenter 200 powered by one or more solar panels 710 in accordance with one or more embodiments of the present invention. A solar farm 700 typically includes a plurality of solar panels 710, each of which intermittently generates a solar-generated DC voltage 720. Solar-generated DC voltage 720 may vary based on a type, kind, or configuration of farm 700, panel 710, and incident sunlight. Solar-generated DC voltage 720 produced by the plurality of solar panels 710 is collected 725 and provided 730 to a DC-to-AC inverter that converts solar-generated DC voltage into three-phase solar-generated AC voltage 750 Three-phase solar-generated AC voltage 750 is provided to an AC-to-AC step-up transformer 760 that steps up three-phase solar-generated AC voltage to three-phase grid AC voltage 790. Three-phase grid AC voltage 790 may be stepped down with an AC-to-AC step-down transformer 785 configured to produce three-phase local station AC voltage 777 provided to local station 775. One of ordinary skill in the art will recognize that the actual voltage levels may vary' based on the type, kind, or number of solar panels 710, the configuration or design of solar farm 700, and grid 790 that it feeds into.

[0059] The output side of AC-to-AC step-up transformer 760 that connects to grid 790 may be metered and is typically subject to transmission and distribution costs. In contrast, power consumed on the input side of AC-to-AC step-up transformer 760 may be considered behind-the-meter and is typically not subject to transmission and distribution costs. As such, one or more flexible datacenters 200 may be powered by

three-phase solar-generated AC voltage 750. Specifically, in solar farm 700 applications, the three-phase behind-the-meter AC voltage used to power flexible datacenter 200 may be three-phase solar-generated AC voltage 750. As such, flexible datacenter 200 may reside behind-the-meter, avoid transmission and distribution costs, and may be dynamically powered when unutilized behind-the-meter power is available.

[0060] Unutilized behind-the-meter power availability may occur when there is excess local power generation. In high incident sunlight situations, solar farm 700 may generate more power than, for example, AC-to-AC step-up transformer 760 is rated for. In such situations, solar farm 700 may have to take steps to protect its equipment from damage, which may include taking one or more panels 710 offline or shunting their voltage to dummy loads or ground. Advantageously, one or more flexible datacenters 200 may be used to consume power on the input side of AC-to-AC step-up transformer 760, thereby allowing solar farm 700 to operate equipment within operating ranges while flexible datacenter 200 receives behind-the-meter power without transmission or distribution costs. The local station control system (not independently illustrated) of local station 775 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenters 200, the remote mater control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0061] Another example of unutilized behind-the-meter power availability is when grid 790 cannot, for whatever reason, take the power being produced by solar farm 700. In such situations, solar farm 700 may have to take one or more panels 710 offline or shunt their voltage to dummy loads or ground. Advantageously, one or more flexible datacenters 200 may be used to consume power on the input side of AC-to-AC step-up transformer 760, thereby allowing solar farm 700 to either produce power to grid 790 at a lower level or shut down transformer 760 entirely while flexible datacenter 200 receives behind-the-meter power without transmission or distribution costs. The local station control system (not independently illustrated) of local station 775 or the grid operator (not independently illustrated) of grid 790 may issue an operational directive to the one or more flexible datacenters 200 or to

the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenters 200, the remote master control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0062] Another example of unutilized behind-the-meter power availability is when solar farm 700 is selling power to grid 790 at a negative price that is offset by a production tax credit. In certain circumstances, the value of the production tax credit may exceed the price solar farm 700 would have to pay to grid 790 to offload their generated power. Advantageously, one or more flexible datacenters 200 may be used to consume power behind-the-meter, thereby allowing solar farm 700 to produce and obtain the production tax credit, but sell less power to grid 790 at the negative price. The local station control system (not independently illustrated) of local station 775 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenter 200, the remote master control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0063] Another example of unutilized behind-the-meter power availability is when solar farm 700 is selling power to grid 790 at a negative price because grid 790 is oversupplied or is instructed to stand down and stop producing altogether. The grid operator (not independently illustrated) may select certain power generation stations to go offline and stop producing power to grid 790. Advantageously, one or more flexible datacenters 200 may be used to consume power behind-the-meter, thereby allowing solar farm 700 to stop producing power to grid 790, but making productive use of the power generated behind-the-meter without transmission or distribution costs. The local station control system (not independently illustrated) of the local station *775* or the grid operator (not independently illustrated) of grid 790 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of

multiple flexible datacenters 200, the remote master control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0064] Another example of unutilized behind-the-meter power availability is when solar farm 700 is producing power to grid 790 that is unstable, out of phase, or at the wrong frequency, or grid 790 is already unstable, out of phase, or at the wrong frequency for whatever reason. The grid operator (not independently illustrated) may select certain power generation stations to go offline and stop producing power to grid 790. Advantageously, one or more flexible datacenters 200 may be used to consume power behind-the-meter, thereby allowing solar farm 700 to stop producing power to grid 790, but make productive use of the power generated behind-the-meter without transmission or distribution costs. The local station control system (not independently illustrated) of local station 775 may issue an operational directive to the one or more flexible datacenters 200 or to the remote master control system (420 of Figure 4) to ramp-up to the desired power consumption level. When the operational directive requires the cooperative action of multiple flexible datacenters 200, the remote master control system (420 of Figure 4) may determine how to power each individual flexible datacenter 200 in accordance with the operational directive or provide an override to each flexible datacenter 200.

[0065] Further examples of unutilized behind-the-meter power availability is when solar farm 700 experiences intermittent cloud cover such that it is not economically feasible to power up certain components, such as, for example local station 775, but there may be sufficient behind-the-meter power availability to power one or more flexible datacenters 200. Similarly, unutilized behind-the-meter power availability may occur when solar farm 700 is starting up, or testing, one or more panels 710. Panels 710 are frequently offline for installation, maintenance, and service and must be tested prior to coming online as part of the array. One or more flexible datacenters 200 may be powered by one or more panels 710 that are offline from farm 700. The above-noted examples of when unutilized behind-the-meter power is available are merely exemplary- and are not intended to limit the scope of what one of ordinary skill in the art would recognize as unutilized behind-the-meter power availability. Behind-the-meter power availability may occur anytime there is power

available and accessible behind-the-meter that is not subject to transmission and distribution costs and there is an economic advantage to using it.

[0066] One of ordinary skill in the art will recognize that solar farm 700 and solar panel 710 may vary based on an application or design in accordance with one or more embodiments of the present invention.

[0067] Figure 8 shows a flexible datacenter 200 powered by flare gas 800 in accordance with one or more embodiments of the present invention. Flare gas 800 is combustible gas produced as a product or by-product of petroleum refineries, chemical plants, natural gas processing plants, oil and gas drilling rigs, and oil and gas production facilities. Flare gas 800 is typically burned off through a flare stack (not shown) or vented into the air. In one or more embodiments of the present invention, flare gas 800 may be diverted 812 to a gas-powered generator that produces three-phase gas-generated AC voltage 822. This power may be considered behind-the-meter and is not subject to transmission and distribution costs. As such, one or more flexible datacenters 200 may be powered by three-phase gas-generated AC voltage. Specifically, the three-phase behind-the-meter AC voltage used to power flexible datacenter 200 may be three-phase gas-generated AC voltage 822. Accordingly, flexible datacenter 200 may reside behind-the-meter, avoid transmission and distribution costs, and may be dynamically powered when unutilized behind-the-meter power is available.

[0068] Figure 9 shows a method of dynamic power delivery to a flexible datacenter (200 of Figure 2) using unutilized behind-the-meter power 900 in accordance with one or more embodiments of the present invention. In step 910, the datacenter control system (220 of Figure 4), or the remote master control system (420 of Figure 4), may monitor unutilized behind-the-meter power availability. In certain embodiments, monitoring may include receiving information or an operational directive from the local station control system (410 of Figure 4) or the grid operator (440 of Figure 4) corresponding to unutilized behind-the-meter power availability.

[0069] In step 920, the datacenter control system (220 of Figure 4), or the remote master control system (420 of Figure 4), may determine when a datacenter ramp-up condition is met. In certain embodiments, the datacenter ramp-up condition may be met when there is sufficient behind-the-meter power availability and there is no operational directive from the local station to go offline or reduce power. In step 930, the datacenter control system (220 of Figure 4) may enable behind-the-meter

power delivery to one or more computing systems (100 of Figure 2). In step 940, once ramped-up, the datacenter control system (220 of Figure 4) or the remote master control system (420 of Figure 4) may direct one or more computing systems (100 of Figure 2) to perform predetermined computational operations. In certain embodiments, the predetermined computational operations may include the execution of one or more hashing functions.

[0070] While operational, the datacenter control system (220 of Figure 4), or the remote master control system (420 of Figure 4), may receive an operational directive to modulate power consumption. In certain embodiments, the operational directive may be a directive to reduce power consumption. In such embodiments, the datacenter control system (220 of Figure 4) or the remote master control system (420 of Figure 4) may dynamically reduce power delivery to one or more computing systems (100 of Figure 2) or dynamically reduce power consumption of one or more computing systems. In other embodiments, the operational directive may be a directive to provide a power factor correction factor. In such embodiments, the datacenter control system (220 of Figure 4) or the remote master control system (420 of Figure 4) may dynamically adjust power delivery to one or more computing systems (100 of Figure 2) to achieve a desired power factor correction factor. In still other embodiments, the operational directive may be a directive to go offline or power down. In such embodiments, the datacenter control system (220 of Figure 4) may disable power delivery to one or more computing systems (100 of Figure 2).

[0071] The datacenter control system (220 of Figure 4), or the remote master control system (420 of Figure 4), may determine when a datacenter ramp-down condition is met. In certain embodiments, the datacenter ramp-down condition may be met if there is insufficient or anticipated to be insufficient behind-the-meter power availability or there is an operational directive from the local station to go offline or reduce power. The datacenter control system (220 of Figure 4) may disable behind-the-meter power delivery, to one or more computing systems (100 of Figure 2). Once ramped-down, the datacenter control system (220 of Figure 4) remains powered and in communication with the remote master control system (420 of Figure 4) so that it may dynamically pow er the flexible datacenter (200 of Figure 2) when conditions change.

[0072] One of ordinary skill in the art will recognize that a datacenter control system (220 of Figure 4) may dynamically modulate power delivery' to one or more

computing systems (100 of Figure 2) of a flexible datacenter (200 of Figure 2) based on unutilized behind-the-meter power availability or an operational directive. The flexible datacenter (200 of Figure 2) may transition between a fully powered down state (while the datacenter control system remains powered), a fully powered up state, and various intermediate states in between. In addition, flexible datacenter (200 of Figure 2) may have a blackout state, where ail power consumption, including that of the datacenter control system (220 of Figure 4) is halted. However, once the flexible datacenter (200 of Figure 2) enters the blackout state, it will have to be manually rebooted to restore power to datacenter control system (220 of Figure 4). Local station conditions or operational directives may cause flexible datacenter (200 of Figure 2) to ramp-up, reduce power consumpti on, change power factor, or ramp-down

[0073] Advantages of one or more embodiments of the present invention may include one or more of the following:

[0074] In one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible datacenter using unutilized energy sources provides a green solution to two prominent problems: the exponential increase in power required for growing blockchain operations and the unutilized and typically wasted energy generated from renewable energy sources.

[0075] In one or more embodiments of the present invention, a method and system for dynamic power deliver}- to a flexible datacenter using unutilized energy sources allows for the rapid deployment of mobile datacenters to local stations. The mobile datacenters may be deployed on site, near the source of power generation, and receive unutilized behind-the-meter power when it is available.

[0076] In one or more embodiments of the present invention, a method and system for dynamic power deliver}- to a flexible datacenter using unutilized energy sources allows for the power delivery to the datacenter to be modulated based on conditions or an operational directive received from the local station or the grid operator.

[0077] In one or more embodiments of the present invention, a method and system for dynamic power deliver}- to a flexible datacenter using unutilized energy sources may dynamically adjust power consumption by ramping-up, ramping-down, or adjusting the power consumption of one or more computing systems within the flexible datacenter.

[0078] In one or more embodiments of the present invention, a method and system for dynamic power delivery to a flexible datacenter using unutilized energy sources may be powered by unutilized behind-the-meter power that is free from transmission and distribution costs. As such, the flexible datacenter may perform computational operations, such as hashing function operations, with little to no energy cost.

[0079] In one or more embodiments of the present invention, a method and system for dynamic power delivery, to a flexible datacenter using unutilized energy sources provides a number of benefits to the hosting local station. The local station may use the flexible datacenter to adjust a load, provide a power factor correction, to offload pow er, or operate in a manner that invokes a production tax credit.

[0080] While the present invention has been described with respect to the above-noted embodiments, those skilled in the art, having the benefit of this disclosure, will recognize that other embodiments may be devised that are within the scope of the invention as disclosed herein. Accordingly, the scope of the invention should be limited only by the appended claims.

CLAIMS

What is claimed is:

1. A flexible datacenter comprising:
a mobile container;
a behind-the-meter power input system;
a power distribution system;
a datacenter control system;
a plurality of computing systems; and
a climate control system,
wherein the datacenter control system modulates power delivery to the plurality of computing systems based on unutilized behind-the-meter power availability or an operational directive.

2. The flexible datacenter of claim 1, further comprising:
a remote master control system.

3. The flexible datacenter of claim 1, wherein the behind-the-meter power input system comprises an input configured to receive three-phase behind-the-meter AC voltage and a supervisory AC-to-AC step-down transformer configured to step down the three-phase behind-the-meter AC voltage to a single-phase supervisory nominal AC voltage or an input configured to receive single-phase supervisory nominal AC voltage from a local station or metered source.

4. The flexible datacenter of claim 3, wherein the behind-the-meter power input system provides the single-phase supervisory nominal AC voltage to the datacenter control system

5 The flexible datacenter of claim 1, wherein the behind-the-meter power input system comprises an input configured to receive three-phase behind-the-meter AC voltage and an operational AC-to-AC step-down transformer configured to controllab!y step down the three-phase behind-the-meter AC voltage to three-phase nominal AC voltage.

6. The flexible datacenter of claim 5, wherein the datacenter control system controllably enables or disables generation of the three-phase nominal AC voltage by the operational AC-to-AC step-down transformer.

7 The flexible datacenter of claim 1, wherein the behind-the-meter power input system provides three-phases of the three-phase nominal AC voltage to the power distribution system

8 The flexible datacenter of claim 7, wherein the power distribution system controllably provides a single phase of the three-phase nominal AC voltage to each computing system of the plurality of computing systems.

9. The flexible data center of claim 7, wherein the datacenter control system controllably selects which phase of the three-phase nominal AC voltage the power distribution system provides to each computing system of the plurality of computing systems

10. The flexible datacenter of claim 7, wherein the datacenter control system modulates a power factor correction factor by controllably adjusting which phase of the three-phase nominal AC voltage each computing system of the plurality of computing systems receive.

11. The flexible datacenter of claim 5, wherein the three-phase behind-the-meter AC voltage comprises a three-phase wind-generated AC voltage output by one or more wind turbines prior to an AC-to-AC step-up transformer that steps up the three-phase wind-generated AC voltage to a three-phase grid AC voltage.

12 The flexible datacenter of claim 5, wherein the three-phase behind-the-meter AC voltage comprises a three-phase solar-generated AC voltage output by a DC-to-AC inverter that inputs solar-generated DC voltage from one or more solar panels and prior to an AC-to-AC step-up transformer that steps up the three-phase solar-generated AC voltage to a three-phase grid AC voltage.

13. The flexible datacenter of claim 5, wherein the three-phase behind-the-meter AC voltage comprises a three-phase gas-generated AC voltage output by a generator that inputs combustible gas diverted from a flare or venting system

14. The flexible datacenter of claim 5, wherein the three-phase behind-the-meter AC voltage is a three-phase metered AC voltage.

15. The flexible datacenter of claim 1, wherein unutilized behind-the-meter power availability comprises one or more of excess local power generation at a local station level, excess local power generation that a grid cannot receive, local power generation subject to economic curtailment, local power generation subject to reliability curtailment, local power generation subject to power factor correction, low local power generation, start up local power generation situations, transient local power generation situations, or testing local power generation situations where there is an economic advantage to using local behind-the-meter power generation to power the flexible datacenter.

16. The flexible datacenter of claim 1, wherein an operational directive comprises one or more of a local station directive, a remote master control directive, or a grid directive.

17 The flexible datacenter of claim 1, wherein an operational directive comprises one or more of a dispatchability directive or a forecast directive.

18. The flexible datacenter of claim 1, wherein an operational directive comprises a workload directive based on actual behind-the-meter power availability or projected behind-the-meter power availability

19 The flexible datacenter of claim 2, wherein the remote master control system dynamically adjusts power delivery to the flexible datacenter based on a remote master control directive.

20 The flexible datacenter of claim 1, wherein the climate control system comprises a computer room air conditioner system, a computer room air handler system, an evaporative cooling system, a refrigerant cooling system, an immersive cooling system,

or any other suitable heat extraction system configured to operate the plurality of computing systems within their operational temperature range

21. The flexible datacenter of claim 1, wherein the mobile container comprises a storage container configured for placement on a ground surface.

22. The flexible datacenter of claim 1, wherein the mobile container comprises a storage trailer on wheels.

23. The flexible datacenter of claim 5, further comprising a battery system configured to convert the three-phase nominal AC voltage to DC nominal voltage and store power in a plurality of storage cells.

24 The flexible datacenter of claim 23, wherein the DC nominal voltage from the plurality of storage cells are converted via a DC-to-AC inverter to three-phase nominal AC voltage for flexible datacenter use

25 A method of dynamic power deliver} to a flexible datacenter using unutilized behind-the-meter power comprising:

monitoring unutilized behind-the-meter power availability;

determining when a datacenter ramp-up condition is met;

enabling behind-the-meter power delivery to one or more computing systems when the datacenter ramp-up condition is met; and

directing the one or more computing systems to perform predetermined computational operations

26 The method of claim 25, further comprising;

determining when a datacenter ramp-down condition is met; and

disabling power delivery to one or more computing systems when the datacenter ramp-down condition is met.

27 The method of claim 25, further comprising:

receiving an operational directive to go offline; and

disabling power delivery to the one or more computing systems.

28. The method of claim 25, further comprising:
    receiving an operational directive to reduce power consumption, and
    dynamically reducing power delivery to a subset of the one or more computing systems

29. The method of claim 25, further comprising:
    receiving an operational directive to reduce power consumption; and
    dynamically reducing power consumption of the one or more computing systems.

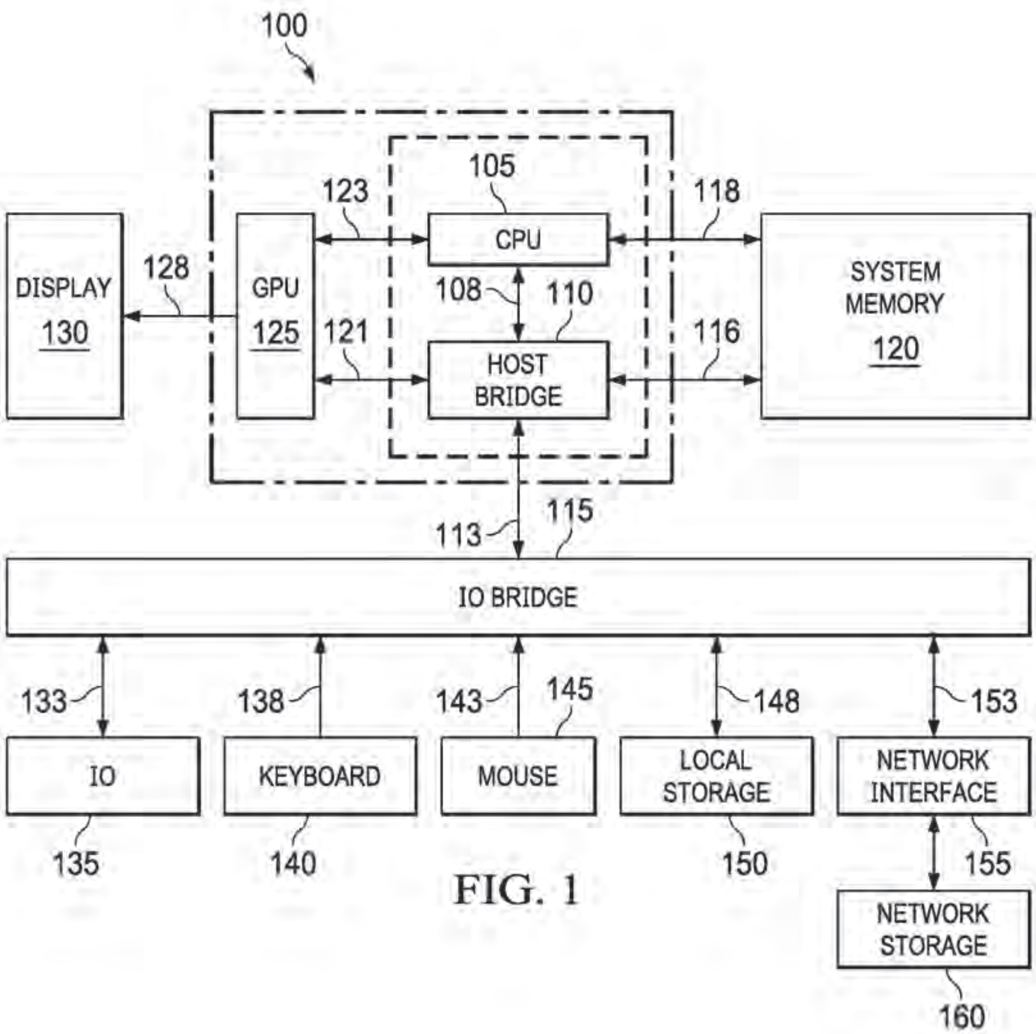
30. The method of claim 25, further comprising:
    receiving an operational directive to provide power factor correction; and
    dynamically adjusting power delivery to a subset of the one or more computing systems to achieve a desired power factor correction factor.

31. The method of claim 25, wherein unutilized behind-the-meter power availability comprises one or more of excess local power generation at a local station level, excess local power generation that a grid cannot receive, local power generation subject to economic curtailment, local power generation subject to reliability curtailment, local power generation subject to power factor correction, low local power generation, start up local power generation situations, transient local power generation situations, or testing local power generation situations where there is an economic advantage to using local behind-the-meter power generation.

32. The method of claim 25, wherein the datacenter ramp-up condition is met if there is sufficient behind-the-meter power availability and there is no operational directive from a local station to go offline.

33 The method of claim 25, wherein the datacenter ramp-down condition is met if there is insufficient behind-the-meter power availability or there is an operational directive from a local station to go offline.

34. The method of claim 25, wherein the predetermined computational operations comprise execution of one or more hashing functions.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CPU
DISPLAY
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HOST
BRIDGE
113
115
IO BRIDGE
133
138
143
145
148
153
IO
KEYBOARD
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LOCAL
STORAGE
NETWORK
INTERFACE
135
140
150
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NETWORK
STORAGE
160

FIG. 1

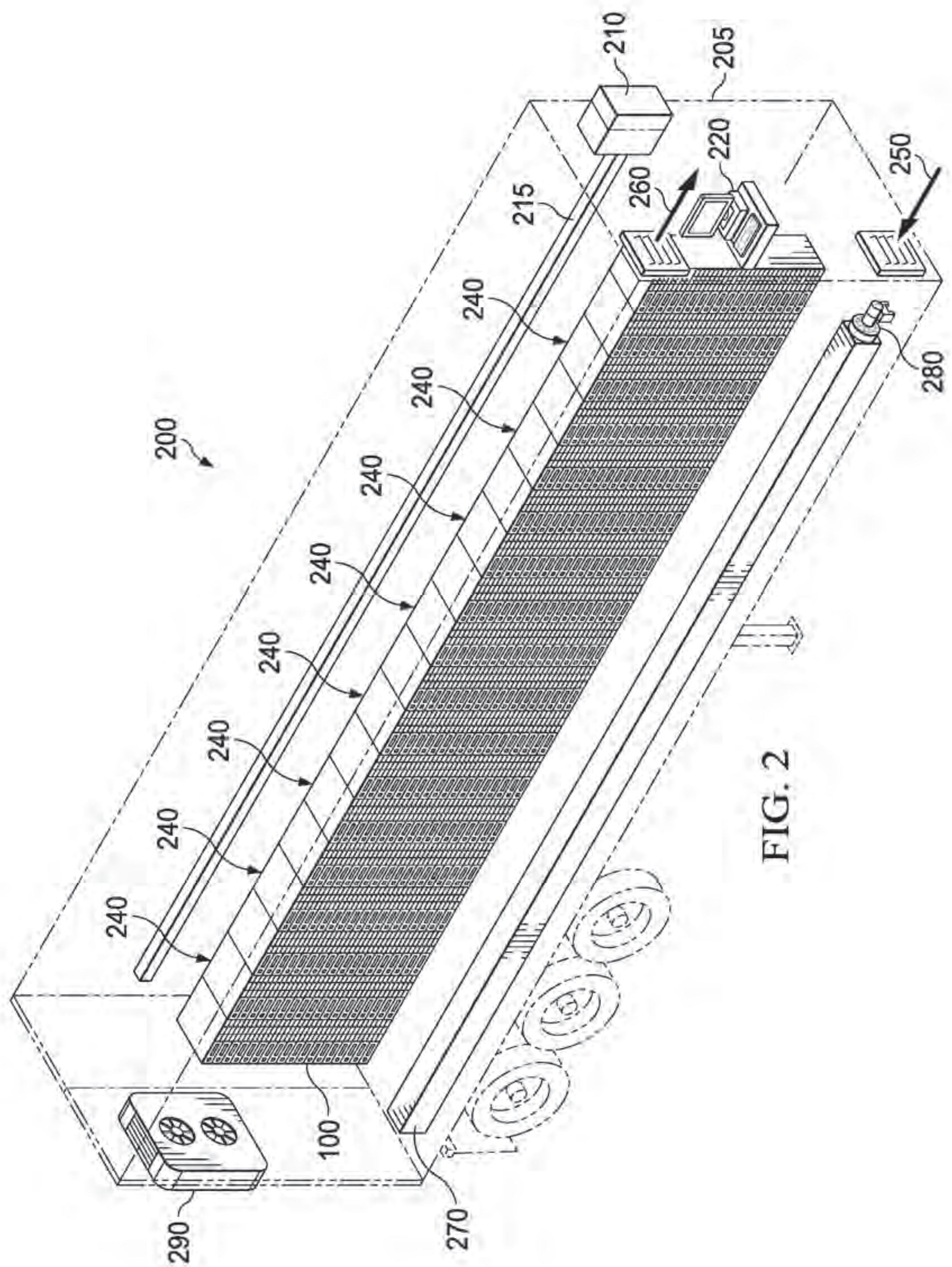


FIG. 2

LANCIUM00000084

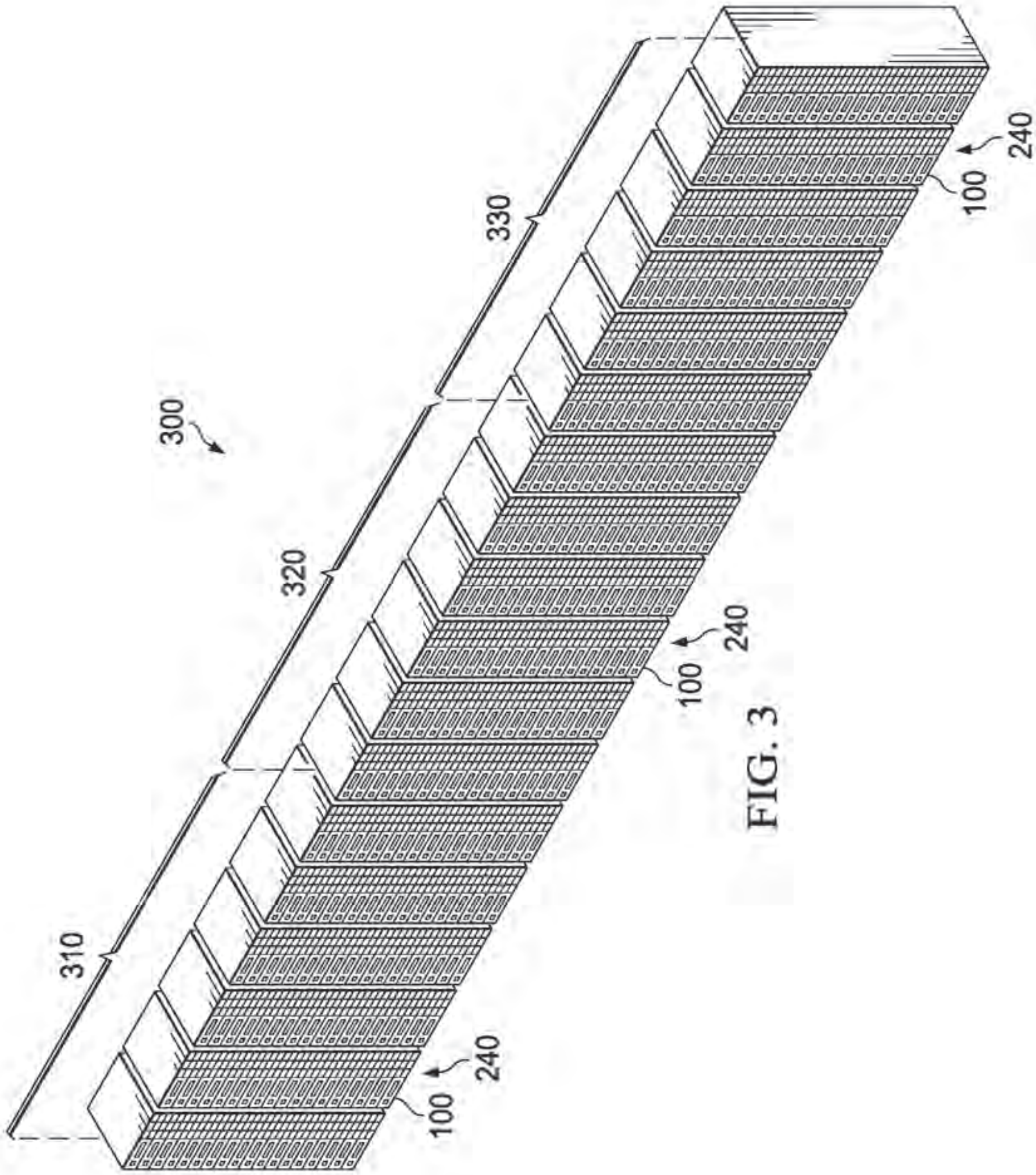


FIG. 3

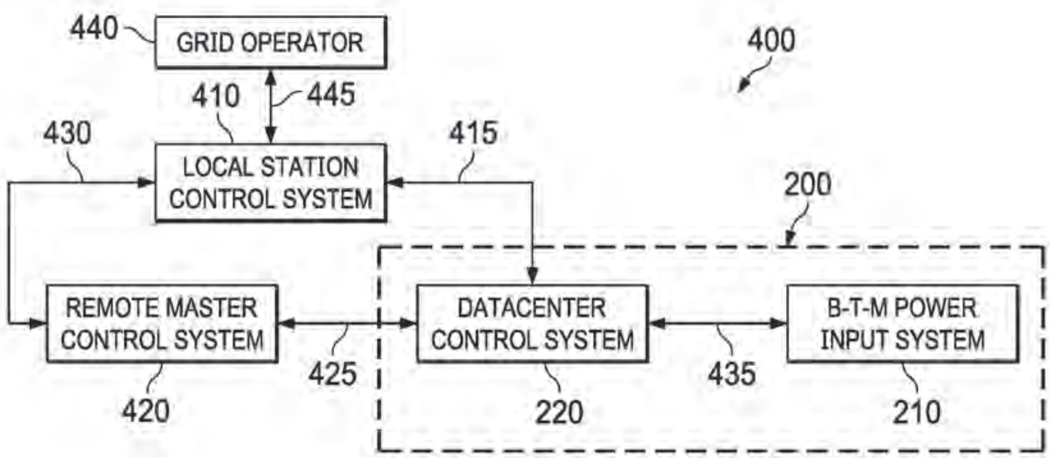
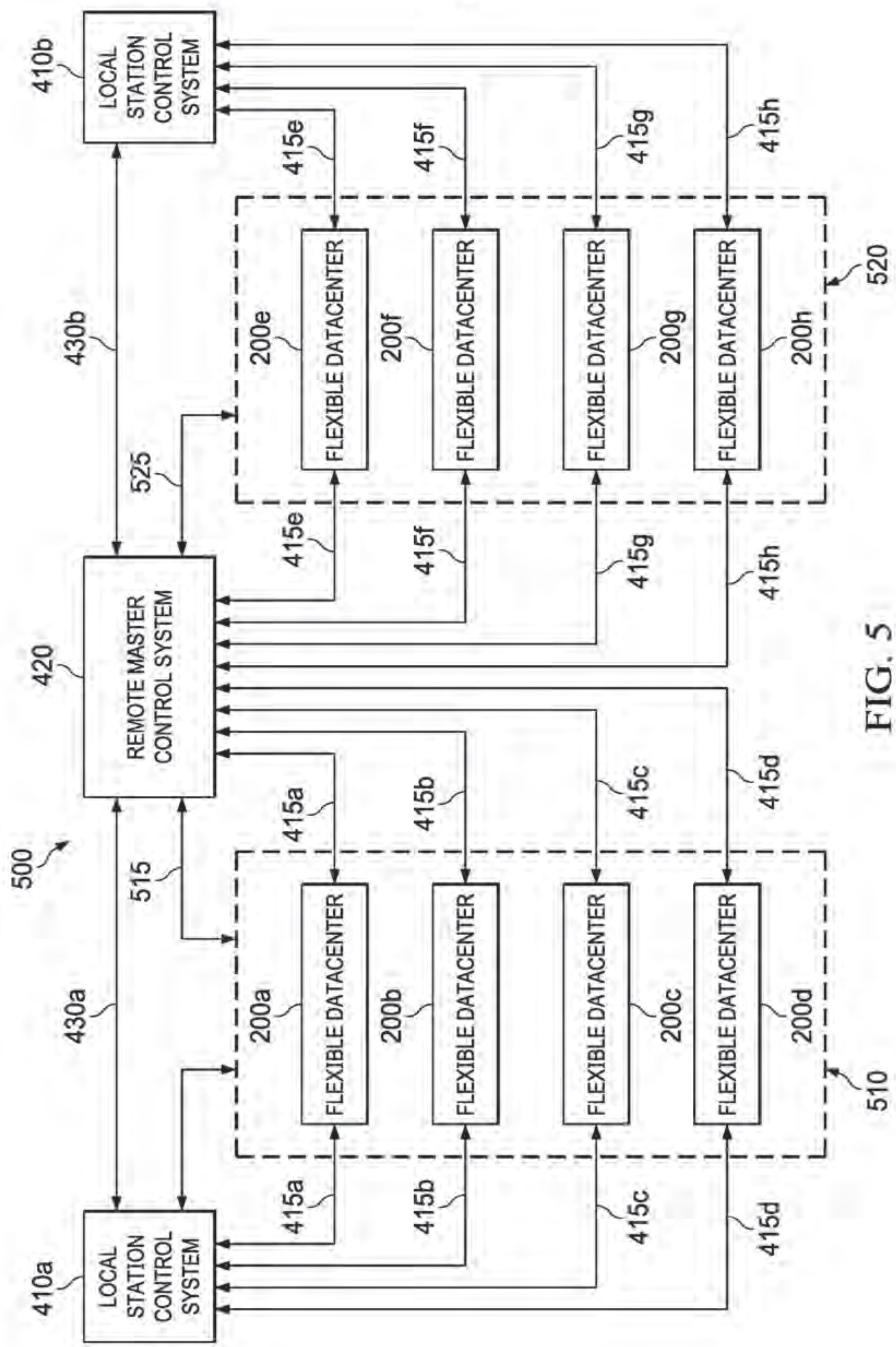

440
GRID OPERATOR
410
445
430
LOCAL STATION CONTROL SYSTEM
415
400
200
REMOTE MASTER CONTROL SYSTEM
DATACENTER CONTROL SYSTEM
B-T-M POWER INPUT SYSTEM
425
435
420
220
210

FIG. 4


500
410a
LOCAL STATION CONTROL SYSTEM
410b
LOCAL STATION CONTROL SYSTEM
420
REMOTE MASTER CONTROL SYSTEM
430a
430b
515
525
510
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415a
415b
415c
415d
415e
415f
415g
415h
200a
200b
200c
200d
200e
200f
200g
200h
FLEXIBLE DATACENTER

FIG. 5

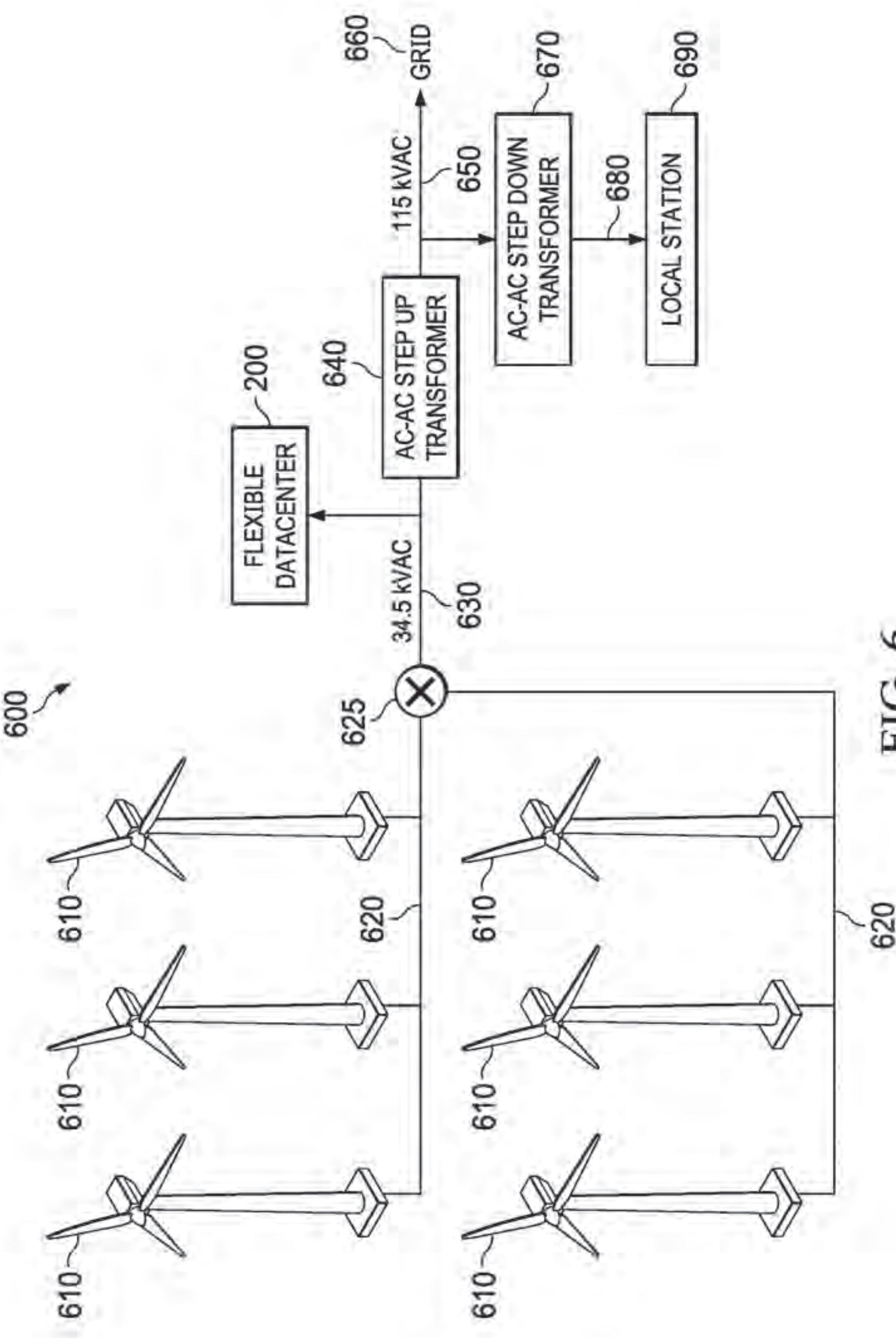
600
610
610
610
610
610
610
620
620
625
34.5 kVAC
630
FLEXIBLE DATACENTER
200
AC-AC STEP UP TRANSFORMER
640
115 kVAC
650
GRID
660
AC-AC STEP DOWN TRANSFORMER
670
680
LOCAL STATION
690

FIG. 6

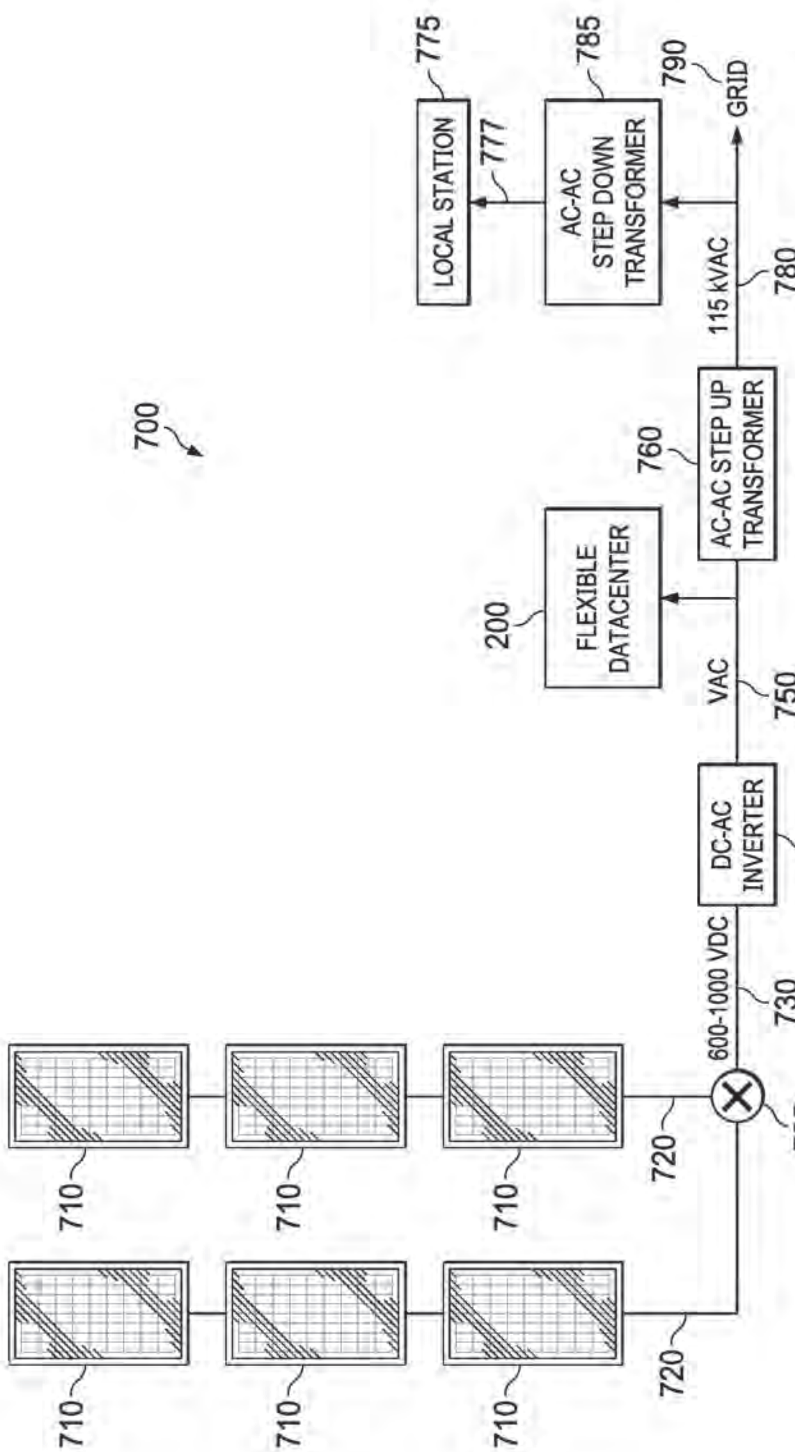
700
710
710
710
710
710
710
720
720
725
600-1000 VDC
730
DC-AC
INVERTER
740
VAC
750
FLEXIBLE
DATACENTER
200
AC-AC STEP UP
TRANSFORMER
760
115 kVAC
780
AC-AC
STEP DOWN
TRANSFORMER
785
LOCAL STATION
775
777
GRID
790

FIG. 7

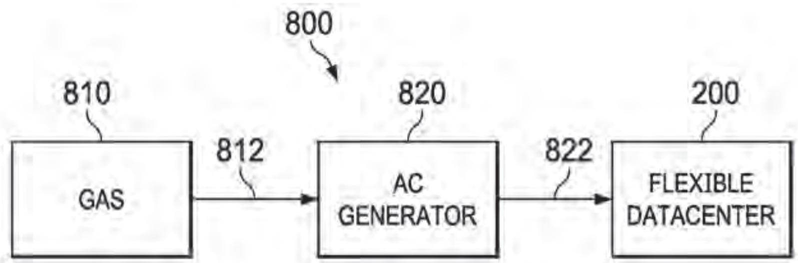
800
810
820
200
812
822
GAS
AC GENERATOR
FLEXIBLE DATACENTER

FIG. 8

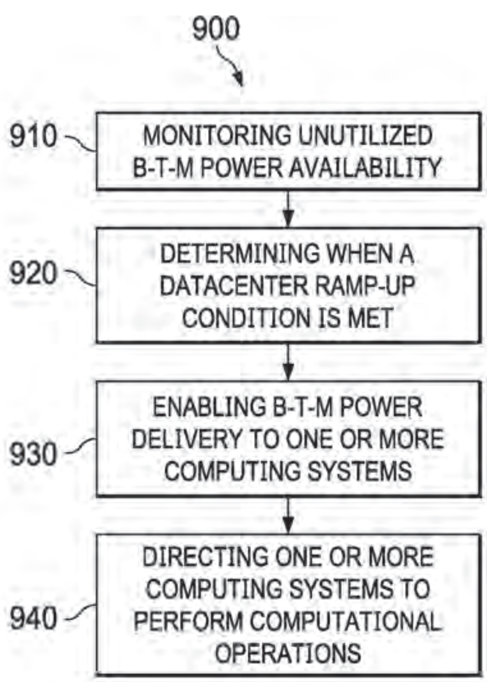
900
910
MONITORING UNUTILIZED B-T-M POWER AVAILABILITY
920
DETERMINING WHEN A DATACENTER RAMP-UP CONDITION IS MET
930
ENABLING B-T-M POWER DELIVERY TO ONE OR MORE COMPUTING SYSTEMS
940
DIRECTING ONE OR MORE COMPUTING SYSTEMS TO PERFORM COMPUTATIONAL OPERATIONS

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/017950

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 1/26; G06F 1/20; G06F 1/30; G06F 1/32 (2018.01)
CPC - G06F 1/26; H05K 7/1497; G06F 1/20; H05K 7/1485 (2018.05)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 713/300; 361/679.46; 361/679.02 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2008/0094797 A1 (COGLITORE et al) 24 April 2008 (24.04.2008) entire document	1, 7, 15-18, 20-22 --- 2-6, 8-14, 19, 23, 24
Y	US 2010/0211810 A1 (ZACHO) 19 August 2010 (19.08.2010) entire document	2, 19
Y	US 2008/0030078 A1 (WHITTED et al) 07 February 2008 (07.02.2008) entire document	3-6, 8-14, 23, 24
Y	US 2013/0063991 A1 (XIAO et al) 14 March 2013 (14.03.2013) entire document	12
Y	US 2015/0155712 A1 (INERTECH IP LLC) 04 June 2015 (04.06.2015) entire document	24
A	US 2010/0328849 A1 (EWING et al) 30 December 2010 (30.12.2010) entire document	1-24
A	US 2013/0306276 A1 (DUCHESNEAU) 21 November 2013 (21.11.2013) entire document	1-24
A	US 2012/0300524 A1 (FORNAGE et al) 29 November 2012 (29.11.2012) entire document	1-24

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 May 2018	31 MAY 2018

Name and mailing address of the ISA/US	Authorized officer
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

LANCIUM00000091

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/017950

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See extra sheet(s).

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-24

Remark on Protest
☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (January 2015)

LANCIUM00000092

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/017950

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-24, are drawn to a flexible datacenter comprising: a mobile container; and a behind-the-meter power input system.

Group II, claims 25-34, are drawn to a method of dynamic power delivery to a flexible datacenter using unutilized behind-the meter power comprising: monitoring unutilized behind-the-meter power availability; and determining when a datacenter ramp-up condition is met.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: a flexible datacenter comprising; a mobile container; a behind-the-meter power input system; a power distribution system; a datacenter control system; and a climate control system, wherein the datacenter control system modulates power delivery to the plurality of computing systems as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: monitoring unutilized behind-the-meter power availability; determining when a datacenter ramp-up condition is met; enabling behind-the-meter power delivery to one or more computing systems when the datacenter ramp-up condition is met; and directing the one or more computing systems to perform predetermined computational operations as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of a flexible datacenter comprising one or more computing systems; and power delivery to the flexible datacenter using unutilized behind-the meter power availability, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2010/0328849 to Ewing teaches a datacenter comprising one or more computing systems; and power delivery to the datacenter using power availability (if a server demands 500 watts and the PUE for the datacenter is 3.0, then the power from the utility grid needed to deliver 500 watts to the server is 1500 watts. The DCIE, in comparison, may provide a different aspect of this information, a DCIE value of 0.33 (equivalent to a PUE of 3.0) suggesting that the computing equipment consumes 33% of the power in the data center, para.0060). Further, US 2013/0306276 to Duchesneau teaches a flexible datacenter (supercomputing datacenter, Para. [0315. Maximum flexibility, para. 1500]); and using unutilized behind-the meter power availability (PERKS is hybrid energy system combining UPS with a peak-shaving system that directly captures excess or low-cost energy from a multiplicity of sources (when it is cheapest or most readily available) and stores it for later reuse, such as during peak periods, Para. [1456]. Note that excess energy is hereby "unutilized behind the meter power" as defined by applicant in Para [0041] of the specification of the present application).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.

APPLICATION FOR UNITED STATES PATENT
UNITED STATES PATENT AND TRADEMARK OFFICE
MBHB Case No. 19-2070-PRO

Title: Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement

Inventors: Michael T. McNamara
Raymond E. Cline Jr.

FIELD

[0001] This specification relates to power consumption adjustments when using grid power and/or intermittent behind-the-meter power.

BACKGROUND

[0002] "Electrical grid" or "grid," as used herein, refers to a Wide Area Synchronous Grid (also known as an Interconnection), and is a regional scale or greater electric power grid that that operates at a synchronized frequency and is electrically tied together during normal system conditions. An electrical grid delivers electricity from generation stations to consumers. An electrical grid includes: (i) generation stations that produce electrical power at large scales for delivery through the grid, (ii) high voltage transmission lines that carry that power from the generation stations to demand centers, and (iii) distribution networks carry that power to individual customers.

[0003] Figure 1 illustrates a typical electrical grid, such as a North American Interconnection or the synchronous grid of Continental Europe (formerly known as the UCTE grid). The electrical grid of Figure 1 can be described with respect to the various segments that make up the grid.

[0004] A generation segment 102 includes one or more generation stations that produce utility-scale electricity (typically >50MW), such as a nuclear plant 102a, a coal plant 102b, a wind power station (i.e., wind farm) 102c, and/or a photovoltaic power station (i.e., a solar farm) 102d. Generation stations are differentiated from building-mounted and other decentralized or local wind or solar power applications because they supply power at the utility level and scale (>50MW), rather than to a local user or users. The primary purpose of generation stations is to produce power for distribution through the grid, and in exchange for payment for the supplied electricity. Each of the generation stations 102a-d includes power generation equipment 102e-h, respectively, typically capable of supply utility-scale power (>50MW). For example, the power generation equipment 102g at wind power station 102c includes wind turbines, and the power generation equipment 102h at photovoltaic power station 102d includes photovoltaic panels.

[0005] Each of the generation stations 102a-d may further includes station electrical equipment 102i-l respectively. Station electrical equipment 102i-l are each illustrated in Figure 1 as distinct elements for simplified illustrative purposes only and may, alternatively or additionally, be distributed throughout the power generation equipment, 102e-h, respectively. For example, at wind power station 102c, each wind turbine may include

transformers, frequency converters, power converters, and/or electrical filters. Energy generated at each wind turbine may be collected by distribution lines along strings of wind turbines and move through collectors, switches, transformers, frequency converters, power converters, electrical filters, and/or other station electrical equipment before leaving the wind power station 102c. Similarly, at photovoltaic power station 102d, individual photovoltaic panels and/or arrays of photovoltaic panels may include inverters, transformers, frequency converters, power converters, and/or electrical filters. Energy generated at each photovoltaic panel and/or array may be collected by distribution lines along the photovoltaic panels and move through collectors, switches, transformers, frequency converters, power converters, electrical filters, and/or other station electrical equipment before leaving the photovoltaic power station 102d.

[0006] Each generation station 102a-d may produce AC or DC electrical current which is then typically stepped up to a higher AC voltage before leaving the respective generation station. For example, wind turbines may typically produce AC electrical energy at 600V to 700V, which may then be stepped up to 34.5kV before leaving the generation station 102d. In some cases, the voltage may be stepped up multiple times and to a different voltage before exiting the generation station 102c. As another example, photovoltaic arrays may produce DC voltage at 600V to 900V, which is then inverted to AC voltage and may be stepped up to 34.5kV before leaving the generation station 102d. In some cases, the voltage may be stepped up multiple times and to a different voltage before exiting the generation station 102d.

[0007] Upon exiting the generation segment 102, electrical power generated at generation stations 102a-d passes through a respective Point of Interconnection ("POI") 103 between a generation station (e.g., 102a-d) and the rest of the grid. A respective POI 103 represents the point of connection between a generation station's (e.g. 102a-d) equipment and a transmission system (e.g., transmission segment 104) associated with electrical grid. In some cases, at the POI 103, generated power from generation stations 102a-d may be stepped up at transformer systems 103e-h to high voltage scales suitable for long-distance transmission along transmission lines 104a. Typically, the generated electrical energy leaving the POI 103 will be at 115 kV AC or above, but in some cases it may be as low as, for example, 69 kV for shorter distance transmissions along transmission lines 104a. Each of transformer systems 103e-h may be a single transformer or may be multiple transformers operating in parallel or series and may be co-located or located in geographically distinct

locations. Each of the transformer systems 103e-h may include substations and other links between the generation stations 102a-d and the transmission lines 104a.

[0008] A key aspect of the POI 103 is that this is where generation-side metering occurs. One or more utility-scale generation-side meters 103a-d (e.g., settlement meters) are located at settlement metering points at the respective POI 103 for each generation station 102a-d. The utility-scale generation-side meters 103a-d measure power supplied from generation stations 102a-d into the transmission segment 104 for eventual distribution throughout the grid.

[0009] For electricity consumption, the price consumers pay for power distributed through electric power grids is typically composed of, among other costs, Generation, Administration, and Transmission & Distribution ("T&D") costs. T&D costs represent a significant portion of the overall price paid by consumers for electricity. These costs include capital costs (land, equipment, substations, wire, etc.), costs associated with electrical transmission losses, and operation and maintenance costs.

[0010] For utility-scale electricity supply, operators of generation stations (e.g., 102a-d) are paid a variable market price for the amount of power the operator generates and provides to the grid, which is typically determined via a power purchase agreement (PPA) between the generation station operator and a grid operator. The amount of power the generation station operator generates and provides to the grid is measured by utility-scale generation-side meters (e.g., 103a-d) at settlement metering points. As illustrated in Figure 1, the utility-scale generation-side meters 103a-d are shown on a low side of the transformer systems 103e-h), but they may alternatively be located within the transformer systems 103e-h or on the high side of the transformer systems 103e-h. A key aspect of a utility-scale generation-side meter is that it is able to meter the power supplied from a specific generation station into the grid. As a result, the grid operator can use that information to calculate and process payments for power supplied from the generation station to the grid. That price paid for the power supplied from the generation station is then subject to T&D costs, as well as other costs, in order to determine the price paid by consumers.

[0011] After passing through the utility-scale generation-side meters in the POI 103, the power originally generated at the generation stations 102a-d is transmitted onto and along the transmission lines 104a in the transmission segment 104. Typically, the electrical energy is transmitted as AC at 115 kV+ or above, though it may be as low as 69kV for short transmission distances. In some cases, the transmission segment 104 may include further power conversions to aid in efficiency or stability. For example, transmission segment 104

may include high-voltage DC ("HVDC") portions (along with conversion equipment) to aid in frequency synchronization across portions of the transmission segment 104. As another example, transmission segment 104 may include transformers to step AC voltage up and then back down to aid in long distance transmission (e.g., 230kV, 500 kV, 765 kV, etc.).

[0012] Power generated at the generation stations 104a-d is ultimately destined for use by consumers connected to the grid. Once the energy has been transmitted along the transmission segment 104, the voltage will be stepped down by transformer systems 105a-c in the step down segment 105 so that it can move into the distribution segment 106.

[0013] In the distribution segment 106, distribution networks 106a-c take power that has been stepped down from the transmission lines 104a and distribute it to local customers, such as local sub-grids (illustrated at 106a), industrial customers, including large EV charging networks (illustrated at 106b), and/or residential and retail customers, including individual EV charging stations (illustrated at 106c). Customer meters 106d, 106f measure the power used by each of the grid-connected customers in distribution networks 106a-c. Customer meters 106d are typically load meters that are unidirectional and measure power use. Some of the local customers in the distribution networks 106a-d may have local wind or solar power systems 106e owned by the customer. As discussed above, these local customer power systems 106e are decentralized and supply power directly to the customer(s). Customers with decentralized wind or solar power systems 106e may have customer meters 106f that are bidirectional or net-metering meters that can track when the local customer power systems 106e produce power in excess of the customer's use, thereby allowing the utility to provide a credit to the customer's monthly electricity bill. Customer meters 106d, 106f differ from utility-scale generation-side meters (e.g., settlement meters) in at least the following characteristics: design (electro-mechanical or electronic vs current transformer), scale (typically less than 1600 amps vs. typically greater than 50MW; typically less than 600V vs. typically greater than 14kV), primary function (use vs. supply metering), economic purpose (credit against use vs payment for power), and location (in a distribution network at point of use vs. at a settlement metering point at a Point of Interconnection between a generation station and a transmission line).

[0014] To maintain stability of the grid, the grid operator strives to maintain a balance between the amount of power entering the grid from generation stations (e.g., 102a-d) and the amount of grid power used by loads (e.g., customers in the distribution segment 106). In order to maintain grid stability and manage congestion, grid operators may take steps to reduce the supply of power arriving from generation stations (e.g., 102a-d) when necessary

(e.g., curtailment). Particularly, grid operators may decrease the market price paid for generated power to dis-incentivize generation stations (e.g., 102a-d) from generating and supplying power to the grid. In some cases, the market price may even go negative such that generation station operators must pay for power they allow into the grid. In addition, some situations may arise where grid operators explicitly direct a generation station (e.g., 102a-d) to reduce or stop the amount of power the station is supplying to the grid.

[0015] Power market fluctuations, power system conditions (e.g., power factor fluctuation or generation station startup and testing), and operational directives resulting in reduced or discontinued generation all can have disparate effects on renewal energy generators and can occur multiple times in a day and last for indeterminate periods of time. Curtailment, in particular, is particularly problematic.

[0016] According to the National Renewable Energy Laboratory's Technical Report TP-6A20-60983 (March 2014):

[0017] [C]urtailment [is] a reduction in the output of a generator from what it could otherwise produce given available resources (e.g., wind or sunlight), typically on an involuntary basis. Curtailments can result when operators or utilities command wind and solar generators to reduce output to minimize transmission congestion or otherwise manage the system or achieve the optimal mix of resources. Curtailment of wind and solar resources typically occurs because of transmission congestion or lack of transmission access, but it can also occur for reasons such as excess generation during low load periods that could cause baseload generators to reach minimum generation thresholds, because of voltage or interconnection issues, or to maintain frequency requirements, particularly for small, isolated grids. Curtailment is one among many tools to maintain system energy balance, which can also include grid capacity, hydropower and thermal generation, demand response, storage, and institutional changes. Deciding which method to use is primarily a matter of economics and operational practice.

[0018] "Curtailment" today does not necessarily mean what it did in the early 2000s. Two separate changes in the electric sector have shaped curtailment practices since that time: the utility-scale deployment of wind power, which has no fuel cost, and the evolution of wholesale power markets. These simultaneous changes have led to new operational challenges but have also expanded the array of market-based tools for addressing them.

[0019] Practices vary significantly by region and market design. In places with centrally-organized wholesale power markets and experience with wind power, manual wind energy curtailment processes are increasingly being replaced by transparent offer-based market mechanisms that base dispatch on economics. Market protocols that dispatch generation based on economics can also result in renewable energy plants generating less than what they could potentially produce with available wind or sunlight. This is often referred to by grid operators by other terms, such as "downward dispatch." In places served primarily by vertically integrated utilities, power purchase agreements (PPAs) between the utility and the wind developer increasingly contain financial provisions for curtailment contingencies.

[0020] ****

[0021] Some reductions in output are determined by how a wind operator values dispatch versus non-dispatch. Other curtailments of wind are determined by the grid operator in response to potential reliability events. Still other curtailments result from overdevelopment of wind power in transmission-constrained areas.

[0022] Dispatch below maximum output (curtailment) can be more of an issue for wind and solar generators than it is for fossil generation units because of differences in their cost structures. The economics of wind and solar generation depend on the ability to generate electricity whenever there is sufficient sunlight or wind to power their facilities.

[0023] Because wind and solar generators have substantial capital costs but no fuel costs (i.e., minimal variable costs), maximizing output improves their ability to recover capital costs. In contrast, fossil generators have higher variable costs, such as fuel costs. Avoiding these costs can, depending on the economics of a specific generator, to some degree reduce the financial impact of curtailment, especially if the generator's capital costs are included in a utility's rate base.

[0024] Curtailment may result in available energy being wasted because solar and wind operators have zero variable cost (which may not be true to the same extent for fossil generation units which can simply reduce the amount of fuel that is being used). With wind generation, in particular, it may also take some time for a wind farm to become fully operational following curtailment. As such, until the time that the wind farm is fully

operational, the wind farm may not be operating with optimum efficiency and/or may not be able to provide power to the grid.

SUMMARY

[0025] In an example, a system includes a set of computing systems. The set of computing systems is configured to perform computational operations using power from a power grid. The system also includes a control system configured to monitor a set of conditions and, while monitoring the set of conditions, receive first power option data based, at least in part, on a power option agreement. The first power option data specify a first minimum power threshold associated with a first time interval. The control system is further configured to provide first control instructions for the set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions responsive to receiving the first power option data. The first control instructions comprises a first power consumption target for the set of computing systems for the first time interval, and the first power consumption target is equal to or greater than the first minimum power threshold associated with the first time interval. The control system is also configured to, while monitoring the set of conditions, receive second power option data based, at least in part, on the power option agreement. The second power option data specify a second minimum power threshold associated with a second time interval. Responsive to receiving the second power option data, the control system is configured to provide second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions. The second control instructions comprises a second power consumption target for the set of computing systems for the second time interval, and wherein the second power consumption target is equal to or greater than the second minimum power threshold associated with the second time interval.

[0026] In another example, a method involves monitoring, at a computing system, a set of conditions, and while monitoring the set of conditions, receiving first power option data based, at least in part, on a power option agreement. The first power option data specify a first minimum power threshold associated with a first time interval. The method further involves, responsive to receiving the first power option data, providing first control instructions for a set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions. The first control instructions comprises a first power consumption target for the set of computing systems for the first time interval, and the first power consumption target is equal to or greater than the first minimum power threshold associated with the first time interval. The method further involves, while monitoring the set of conditions, receiving second power option data based, at least in part, on the power option agreement. The second power option data specify a second

minimum power threshold associated with a second time interval. The method also involves, responsive to receiving the second power option data, providing second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions. The second control instructions comprises a second power consumption target for the set of computing systems for the second time interval, and the second power consumption target is equal to or greater than the second minimum power threshold associated with the second time interval.

[0027] In yet another example, a system is provided. The system includes a set of computing systems, where the set of computing systems is configured to perform computational operations using power from a power grid. The system also includes a control system configured to monitor a set of conditions and receive power option data based, at least in part, on a power option agreement. The power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals, where each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals. The control system is further configured to, responsive to receiving the power option data, determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions. The performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals, where each power consumption target is equal to or greater than the minimum power threshold associated with each time interval. The control system is also configured to provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.

[0028] In a further example, non-transitory computer-readable medium is described that is configured to store instructions, that when executed by a computing system, causes the computing system to perform operations consistent with the method steps described above.

[0029] Other aspects of the present invention will be apparent from the following description and claims.

BRIEF DESCRIPTION OF THE FIGURES

[0030] Figure 1 shows a typical electrical grid.

[0031] Figure 2 shows a behind-the-meter arrangement with optional grid power, including one or more flexible datacenters, according to one or more example embodiments.

[0032] Figure 3 shows a block diagram of a remote master control system, according to one or more example embodiments.

[0033] Figure 4 a block diagram of a generation station, according to one or more example embodiments.

[0034] Figure 5 shows a block diagram of a flexible datacenter, according to one or more example embodiments.

[0035] Figure 6A shows a structural arrangement of a flexible datacenter, according to one or more example embodiments.

[0036] Figure 6B shows a set of computing systems arranged in a straight configuration, according to one or more example embodiments.

[0037] Figure 7 shows a control distribution system for a flexible datacenter, according to one or more example embodiments.

[0038] Figure 8 shows a control distribution system for a fleet of flexible datacenters, according to one or more example embodiments.

[0039] Figure 9 shows a queue distribution system for a traditional datacenter and a flexible datacenter, according to one or more example embodiments.

[0040] Figure 10A shows a method of dynamic power consumption at a flexible datacenter using behind-the-meter power, according to one or more example embodiments.

[0041] Figure 10B shows a method of dynamic power delivery at a flexible datacenter using behind-the-meter power, according to one or more example embodiments.

[0042] Figure 11 shows a block diagram of a system for implementing power consumption adjustments based on a power option agreement, according to one or more embodiments.

[0043] Figure 12 shows a graph representing power option data based on a power option agreement, according to one or more embodiments.

[0044] Figure 13 shows a method for implementing power consumption adjustments based on a fixed-duration power option agreement, according to one or more embodiments.

[0045] Figure 14 shows a method for implementing power consumption adjustments based on a dynamic power option agreement, according to one or more embodiments.

DETAILED DESCRIPTION

[0046] Disclosed examples will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all of the disclosed examples are shown. Different examples may be described and should not be construed as limited to the examples set forth herein.

[0047] As discussed above, the market price paid to generation stations for supplying power to the grid often fluctuates due to various factors, including the need to maintain grid stability and based on current demand and usage by connected loads in distribution networks. Due to these factors, situations can arise where generation stations are offered substantially lower prices to deter an over-supply of power to the grid. Although these situations typically exist temporarily, generation stations are sometimes forced to either sell power to the grid at the much lower prices or adjust operations to decrease the amount of power generated. Furthermore, some situations may even require generation stations to incur costs in order to offload power to the grid or to shut down generation temporarily.

[0048] The volatility in the market price offered for power supplied to the grid can be especially problematic for some types of generation stations. In particular, wind farms and some other types of renewable resource power producers may lack the ability to quickly adjust operations in response to changes in the market price offered for supplying power to the grid. As a result, power generation and management at some generation stations can be inefficient, which can frequently result in power being sold to the grid at low or negative prices. In some situations, a generation station may even opt to halt power generation temporarily to avoid such unfavorable pricing. As such, the time required to halt and to restart the power generation at a generation station can reduce the generation station's ability to take advantage of rising market prices for power supplied to the grid.

[0049] Example embodiments provided herein aim to assist generation stations in managing power generation operations and avoid unfavorable power pricing situations like those described above. In particular, example embodiments may involve providing a load that is positioned behind-the-meter ("BTM") and enabling the load to utilize power received behind-the-meter at a generation station in a timely manner. As a general rule of thumb, BTM power is not subject to traditional T&D costs.

[0050] For purposes herein, a generation station is considered to be configured for the primary purpose of generating utility-scale power for supply to the electrical grid (e.g., a Wide Area Synchronous Grid or a North American Interconnect).

[0051] In one embodiment, equipment located behind-the-meter ("BTM equipment") is equipment that is electrically connected to a generation station's power generation equipment behind (i.e., prior to) the generation station's POI with an electrical grid.

[0052] In one embodiment, behind-the-meter power ("BTM power") is electrical power produced by a generation station's power generation equipment and utilized behind (i.e., prior to) the generation station's POI with an electrical grid.

[0053] In another embodiment, equipment may be considered behind-the-meter if it is electrically connected to a generation station that is subject to metering by a utility-scale generation-side meter (e.g., settlement meter), and the BTM equipment receives power from the generation station, but the power received by the BTM equipment from the generation station has not passed through the utility-scale generation-side meter. In one embodiment, the utility-scale generation-side meter for the generation station is located at the generation station's POI. In another embodiment, the utility-scale generation-side meter for the generation station is at a location other than the POI for the generation station – for example, a substation between the generation station and the generation station's POI.

[0054] In another embodiment, power may be considered behind-the-meter if it is electrical power produced at a generation station that is subject to metering by a utility-scale generation-side meter (e.g., settlement meter), and the BTM power is utilized before being metered at the utility-scale generation-side meter. In one embodiment, the utility-scale generation-side meter for the generation station is located at the generation station's POI. In another embodiment, the utility-scale generation-side meter for the generation station is at a location other than the POI for the generation station – for example, a substation between the generation station and the generation station's POI.

[0055] In another embodiment, equipment may be considered behind-the-meter if it is electrically connected to a generation station that supplies power to a grid, and the BTM equipment receives power from the generation station that is not subject to T&D charges, but power received from the grid that is supplied by the generation station is subject to T&D charges.

[0056] In another embodiment, power may be considered behind-the-meter if it is electrical power produced at a generation station that supplies power to a grid, and the BTM power is not subject to T&D charges before being used by electrical equipment, but power received from the grid that is supplied by the generation station is subject to T&D charges.

[0057] In another embodiment, equipment may be considered behind-the-meter if the BTM equipment receives power generated from the generation station and that received power is not routed through the electrical grid before being delivered to the BTM equipment.

[0058] In another embodiment, power may be considered behind-the-meter if it is electrical power produced at a generation station, and BTM equipment receives that generated power, and that generated power received by the BTM equipment is not routed through the electrical grid before being delivered to the BTM equipment.

[0059] For purposes herein, BTM equipment may also be referred to as a behind-the-meter load ("BTM load") when the BTM equipment is actively consuming BTM power.

[0060] Beneficially, where BTM power is not subject to traditional T&D costs, a wind farm or other type of generation station can be connected to BTM loads which can allow the generation station to selectively avoid the adverse or less-than optimal cost structure occasionally associated with supplying power to the grid by shunting generated power to the BTM load.

[0061] An arrangement that positions and connects a BTM load to a generation station can offer several advantages. In such arrangements, the generation station may selectively choose whether to supply power to the grid or to the BTM load, or both. The operator of a BTM load may pay to utilize BTM power at a cost less than that charged through a consumer meter (e.g., 106d, 106f) located at a distribution network (e.g., 106a-c) receiving power from the grid. The operator of a BTM load may additionally or alternatively charge less than the market rate to consume excess power generated at the generation station during curtailment. As a result, the generation station may direct generated power based on the "best" price that the generation station can receive during a given time frame, and/or the lowest cost the generation station may incur from negative market pricing during curtailment. The "best" price may be the highest price that the generation station may receive for its generated power during a given duration, but can also differ within embodiments and may depend on various factors, such as a prior PPA.

[0062] In one example, by having a behind-the-meter option available, a generation station may transition from supplying all generated power to the grid to supplying some or all generated power to one or more BTM loads when the market price paid for power by grid operators drops below a predefined threshold (e.g., the price that the operator of the BTM load is willing to pay the generation station for power). Thus, by having an alternative option for power consumption (i.e., one or more BTM loads), the generation station can selectively utilize the different options to maximize the price received for generated power. In addition,

the generation station may also utilize a BTM load to avoid or reduce the economic impact in situations when supplying power to the grid would result in the generation station incurring a net cost.

[0063] Providing BTM power to a load can also benefit the BTM load operator. A BTM load may be able to receive and utilize BTM power received from the generation station at a cost that is lower than the cost for power from the grid (e.g., at a customer meter 106d, 106f). This is primarily due to the avoidance (or significant reduction) in T&D costs and the market effects of curtailment. As indicated above, the generation station may be willing to divert generated power to the BTM load rather than supplying the grid due to changing market conditions, or during maintenance periods, or for other non-market conditions. Thus, some situations may arise where the generation station offers power to the BTM load at a price that is substantially lower than the price available on the grid. Furthermore, in some situations, the BTM load may even be able to obtain and utilize BTM power from a generation station at no cost or even at negative pricing since the generation station may rather supply the BTM load with generated power during a given time range instead of paying a higher price for the grid to take the power or modifying operations to decrease power output.

[0064] Another example of cost-effective use of BTM power is when the generation station 202 is selling power to the grid at a negative price that is offset by a production tax credit. In certain circumstances, the value of the production tax credit may exceed the price the generation station 202 would have to pay to the grid power to offload generation's station 202 generated power. Advantageously, one or more flexible datacenters 220 may take the generated power behind-the-meter, thereby allowing the generation station 202 to produce and obtain the production tax credit, while selling less power to the grid at the negative price.

[0065] Another example of cost-effective behind-the-meter power is when the generation station 202 is selling power to the grid at a negative price because the grid is oversupplied and/or the generation station 202 is instructed to stand down and stop producing altogether. A grid operator may select and direct certain generation stations to go offline and stop supplying power to the grid. Advantageously, one or more flexible datacenters may be used to take power behind-the-meter, thereby allowing the generation station 202 to stop supplying power to the grid, but still stay online and make productive use of the power generated.

[0066] Another example of beneficial behind-the-meter power use is when the generation station 202 is producing power that is, with reference to the grid, unstable, out of phase, or at the wrong frequency, or the grid is already unstable, out of phase, or at the wrong frequency. A grid operator may select certain generation stations to go either offline and stop producing

power, or to take corrective action with respect to the grid power stability, phase, or frequency. Advantageously, one or more flexible datacenters 220 may be used to selectively consume power behind-the-meter, thereby allowing the generation station 202 to stop providing power to the grid and/or provide corrective feedback to the grid.

[0067] Another example of beneficial behind-the-meter power use is that cost-effective behind-the-meter power availability may occur when the generation station 202 is starting up or testing. Individual equipment in the power generation equipment 210 may be routinely offline for installation, maintenance, and/or service and the individual units must be tested prior to coming online as part of overall power generation equipment 210. During such testing or maintenance time, one or more flexible datacenters may be intermittently powered by the one or more units of the power generation equipment 210 that are offline from the overall power generation equipment 210.

[0068] Another example of beneficial behind-the-meter power use is that datacenter control systems at the flexible datacenters 220 may quickly ramp up and ramp down power consumption by computing systems in the flexible datacenters 220 based on power availability from the generation station 202. For instance, if the grid requires additional power and signals the demand via a higher local price for power, the generation station 202 can supply the grid with power nearly instantly by having active flexible datacenters 220 quickly ramp down and turn off computing systems (or switch to a stored energy source), thereby reducing an active BTM load.

[0069] Another example of beneficial behind-the-meter power use is in new photovoltaic generation stations 202. For example, it is common to design and build new photovoltaic generation stations with a surplus of power capacity to account for degradation in efficiency of the photovoltaic panels over the life of the generation stations. Excess power availability at the generation station can occur when there is excess local power generation and/or low grid demand. In high incident sunlight situations, a photovoltaic generation station 202 may generate more power than the intended capacity of generation station 202. In such situations, a photovoltaic generation station 202 may have to take steps to protect its equipment from damage, which may include taking one or more photovoltaic panels offline or shunting their voltage to dummy loads or the ground. Advantageously, one or more flexible datacenters (e.g., the flexible datacenters 220) may take power behind-the-meter at the Generations Station 202, thereby allowing the generation station 202 to operate the power generation equipment 210 within operating ranges while the flexible datacenters 220 receive BTM power without transmission or distribution costs.

[0070] Thus, for at least the reasons described herein, arrangements that involves providing a BTM load as an alternative option for a generation station to direct its generated power to can serve as a mutually beneficial relationship in which both the generation station and the BTM load can economically benefit. The above-noted examples of beneficial use of BTM power are merely exemplary and are not intended to limit the scope of what one of ordinary skill in the art would recognize as benefits to unutilized BTM power capacity, BTM power pricing, or BTM power consumption.

[0071] Within example embodiments described herein, various types of utility-scale power producers may operate as generation stations 202 that are capable of supplying power to one or more loads behind-the-meter. For instance, renewable energy sources (e.g., wind, solar, hydroelectric, wave, water current, tidal), fossil fuel power generation sources (coal, natural gas), and other types of power producers (e.g., nuclear power) may be positioned in an arrangement that enables the intermittent supply of generated power behind-the-meter to one or more BTM loads. One of ordinary skill in the art will recognize that the generation station 202 may vary based on an application or design in accordance with one or more example embodiments.

[0072] In addition, the particular arrangement (e.g., connections) between the generation station and one or more BTM loads can vary within examples. In one embodiment, a generation station may be positioned in an arrangement wherein the generation station selectively supplies power to the grid and/or to one or more BTM loads. As such, power cost-analysis and other factors (e.g., predicted weather conditions, contractual obligations, etc.) may be used by the generation station, a BTM load control system, a remote master control system, or some other system or enterprise, to selectively output power to either the grid or to one or more BTM loads in a manner that maximizes revenue to the generation station. In such an arrangement, the generation station may also be able to supply both the grid and one or more BTM loads simultaneously. In some instances, the arrangement may be configured to allow dynamic manipulation of the percentage of the overall generated power that is supplied to each option at a given time. For example, in some time periods, the generation station may supply no power to the BTM load.

[0073] In addition, the type of loads that are positioned behind-the-meter can vary within example embodiments. In general, a load that is behind-the-meter may correspond to any type of load capable of receiving and utilizing power behind-the-meter from a generation station. Some examples of loads include, but are not limited to, datacenters and electric vehicle (EV) charging stations.

[0074] Preferred BTM loads are loads that can be subject to intermittent power supply because BTM power may be available intermittently. In some instances, the generation station may generate power intermittently. For example, wind power station 102c and/or photovoltaic power station 102d may only generate power when resource are available or favorable. Additionally or alternatively, BTM power availability at a generation station may only be available intermittently due to power market fluctuations, power system conditions (e.g., power factor fluctuation or generation station startup and testing), and/or operational directives from grid operators or generation station operators.

[0075] Some example embodiments of BTM loads described herein involve using one or more computing systems to serve as a BTM load at a generation station. In particular, the computing system or computing systems may receive power behind-the-meter from the generation station to perform various computational operations, such as processing or storing information, performing calculations, mining for cryptocurrencies, supporting blockchain ledgers, and/or executing applications, etc.

[0076] Multiple computing systems positioned behind-the-meter may operate as part of a "flexible" datacenter that is configured to operate only intermittently and to receive and utilize BTM power to carry out various computational operations similar to a traditional datacenter. In particular, the flexible datacenter may include computing systems and other components (e.g., support infrastructure, a control system) configured to utilize BTM power from one or more generation stations. The flexible datacenter may be configured to use particular load ramping abilities (e.g., quickly increase or decrease power usage) to effectively operate during intermittent periods of time when power is available from a generation station and supplied to the flexible datacenter behind-the-meter, such as during situations when supplying generated power to the grid is not favorable for the generation station.

[0077] In some instances, the amount of power consumed by the computing systems at a flexible datacenter can be ramped up and down quickly, and potentially with high granularity (i.e., the load can be changed in small increments if desired). This may be done based on monitored power system conditions or other information analyses as discussed herein. As recited above, this can enable a generation station to avoid negative power market pricing and to respond quickly to grid directives. And by extension, the flexible datacenter may obtain BTM power at a price lower than the cost for power from the grid.

[0078] Various types of computing systems can provide granular power ramping. Preferably, the computing systems can perform computational tasks that are immune to, or not

substantially hindered by, frequent interruptions or slow-downs in processing as the computing systems ramp down or up. In some embodiments, a control system may be used to activate or de-activate one or more computing systems in an array of computing systems. For example, the control system may provide control instructions to one or more blockchain miners (e.g., a group of blockchain miners), including instructions for powering on or off, adjusting frequency of computing systems performing operations (e.g., adjusting the processing frequency), adjusting the quantity of operations being performed, and when to operate within a low power mode (if available).

[0079] Within examples, a control system may correspond to a specialized computing system or may be a computing system within a datacenter serving in the role of the control system. The location of the control system can vary within examples as well. For instance, the control system may be located at a datacenter or physically separate from the datacenter. In some examples, the control system may be part of a network of control systems that manage computational operations, power consumption, and other aspects of a fleet of datacenters. The fleet of datacenters may include one or more traditional datacenters and/or flexible datacenters.

[0080] Some embodiments may involve using one or more control systems to direct time-insensitive (e.g., interruptible) computational tasks to computational hardware, such as central processing units (CPUs) and graphics processing units (GPUs), sited behind the meter, while other hardware is sited in front of the meter (i.e., consuming metered grid power via a customer meter (e.g., 106d, 106f)) and possibly remote from the behind-the-meter hardware. As such, parallel computing processes, such as Monte Carlo simulations, batch processing of financial transactions, graphics rendering, machine learning, neural network processing, queued operations, and oil and gas field simulation models, are good candidates for such interruptible computational operations.

[0081] Figure 2 shows a behind-the-meter arrangement with optional grid-power, including one or more flexible datacenters, according to one or more example embodiments. Dark arrows illustrate a typical power delivery direction. Consistent with Figure 1, the arrangement illustrates a generation station 202 in the generation segment 102 of a Wide-Area Synchronous Grid. The generation station 202 supplies utility-scale power (typically >50MW) via a generation power connection 250 to the Point of Interconnection 103 between the generation station 202 and the rest of the grid. Typically, the power supplied on connection 250 may be at 34.5kV AC, but it may be higher or lower. Depending on the voltage at connection 250 and the voltage at transmission lines 104a, a transformer system

203 may step up the power supplied from the generation station 202 to high voltage (e.g., 115kV+ AC) for transmission over connection 252 and onto transmission lines 104a of transmission segment 104. Grid power carried on the transmission segment 104 may be from generation station 202 as well as other generation stations (not shown). Also consistent with Figure 1, grid power is consumed at one or more distribution networks, including example distribution network 206. Grid power may be taken from the transmission lines 104a via connector 254 and stepped down to distribution network voltages (e.g., typically 4kV to 26kV AC) and sent into the distribution networks, such as distribution network 206 via distribution line 256. The power on distribution line 256 may be further stepped down (not shown) before entering individual consumer facilities such as a remote master control system 262 and/or traditional datacenters 260 via customer meters 206A, which may correspond to customer meters 106d in Figure 1, or customer meters 106f in Figure 1 if the respective consumer facility includes a local customer power system, such as 106e (not shown in Figure 2).

[0082] Consistent with Figure 1, power entering the grid from generation station 202 is metered by a utility-scale generation-side meter. A utility-scale generation-side meter 253 is shown on the low side of transformer system 203 and an alternative location is shown as 253A on the high side of transformer system 203. Both locations may be considered settlement metering points for the generation station 202 at the POI 103. Alternatively, a utility-scale generation-side meter for the generation station 202 may be located at another location consistent with the descriptions of such meters provided herein.

[0083] Generation station 202 includes power generation equipment 210, which may include, as examples, wind turbines and/or photovoltaic panels. Power generation equipment 210 may further include other electrical equipment, including but not limited to switches, busses, collectors, inverters, and power unit transformers (e.g., transformers in wind turbines).

[0084] As illustrated in Figure 2, generation station 202 is configured to connect with BTM equipment which may function as BTM loads. In the illustrated embodiment of Figure 2, the BTM equipment includes flexible datacenters 220. Various configurations to supply BTM power to flexible datacenters 220 within the arrangement of Figure 2 are described herein.

[0085] In one configuration, generated power may travel from the power generation equipment 210 over one or more connectors 230A, 230B to one or more electrical busses 240A, 240B, respectively. Each of the connectors 230A, 230B may be a switched connector such that power may be routed independently to 240A and/or 240B. For illustrative purposes only, connector 230B is shown with an open switch, and connector 230A is shown with a

closed switch, but either or both may be reversed in some embodiments. Aspects of this configuration can be used in various embodiments when BTM power is supplied without significant power conversion to BTM loads.

[0086] In various configurations, the busses 240A and 240B may be separated by an open switch 240C or combined into a common bus by a closed switch 240C.

[0087] In another configuration, generated power may travel from the power generation equipment 210 to the high side of a local step-down transformer 214. The generated power may then travel from the low side of the local step-down transformer 214 over one or more connectors 232A, 232B to the one or more electrical busses 240A, 240B, respectively. Each of the connectors 232A, 232B may be a switched connector such that power may be routed independently to 240A and/or 240B. For illustrative purposes only, connector 232A is shown with an open switch, and connector 232B is shown with a closed switch, but either or both may be reversed in some embodiments. Aspects of this configuration can be used when it is preferable to connect BTM power to the power generation equipment 210, but the generated power must be stepped down prior to use at the BTM loads.

[0088] In another configuration, generated power may travel from the power generation equipment 210 to the low side of a local step-up transformer 212. The generated power may then travel from the high side of the local step-up transformer 212 over one or more connectors 234A, 234B to the one or more electrical busses 240A, 240B, respectively. Each of the connectors 234A, 234B may be a switched connector such that power may be routed independently to 240A and/or 240B. For illustrative purposes only, both connectors 234A, 234B are shown with open switches, but either or both may be closed in some embodiments. Aspects of this configuration can be used when it is preferable to connect BTM power to the outbound connector 250 or the high side of the local step-up transformer 212.

[0089] In another configuration, generated power may travel from the power generation equipment 210 to the low side of the local step-up transformer 212. The generated power may then travel from the high side of the local step-up transformer 212 to the high side of local step-down transformer 213. The generated power may then travel from the low side of the local step-down transformer 213 over one or more connectors 236A, 236B to the one or more electrical busses 240A, 240B, respectively. Each of the connectors 236A, 2346 may be a switched connector such that power may be routed independently to 240A and/or 240B. For illustrative purposes only, both connectors 236A, 236B are shown with open switches, but either or both may be closed in some embodiments. Aspects of this configuration can be used when it is preferable to connect BTM power to the outbound connector 250 or the high

side of the local step-up transformer 212, but the power must be stepped down prior to use at the BTM loads.

[0090] In one embodiment, power generated at the generation station 202 may be used to power a generation station control system 216 located at the generation station 202, when power is available. The generation station control system 216 may typically control the operation of the generation station 202. Generated power used at the generation station control system 216 may be supplied from bus 240A via connector 216A and/or from bus 240B via connector 216B. Each of the connectors 216A, 216B may be a switched connector such that power may be routed independently to 240A and/or 240B. While the generation station control system 216 can consume BTM power when powered via bus 240A or bus 240B, the BTM power taken by generation station control system 216 is insignificant in terms of rendering an economic benefit. Further, the generation station control system 216 is not configured to operate intermittently, as it generally must remain always on. Further still, the generation station control system 216 does not have the ability to quickly ramp a BTM load up or down.

[0091] In another embodiment, grid power may alternatively or additionally be used to power the generation station control system 216. As illustrated here, metered grid power from a distribution network, such as distribution network 206 for simplicity of illustration purposes only, may be used to power generation station control system 216 over connector 216C. Connector 216C may be a switched connector so that metered grid power to the generation station control system 216 can be switched on or off as needed. More commonly, metered grid power would be delivered to the generation station control system 216 via a separate distribution network (not shown), and also over a switched connector. Any such grid power delivered to the generation station control system 216 is metered by a customer meter 206A and subject to T&D costs.

[0092] In another embodiment, when power generation equipment 210 is in an idle or off state and not generating power, grid power may backfeed into generation station 202 through POI 103 and such grid power may power the generation station control system 216.

[0093] In some configurations, an energy storage system 218 may be connected to the generation station 202 via connector 218A, which may be a switched connector. For illustrative purposes only, connector 218A is shown with an open switch but in some embodiments it may be closed. The energy storage system 218 may be connected to bus 240A and/or bus 240B and store energy produced by the power generation equipment 210. The energy storage system may also be isolated from generation station 202 by switch 242A.

In times of need, such as when the power generation equipment in an idle or off state and not generating power, the energy storage system may feed power to, for example, the flexible datacenters 220. The energy storage system may also be isolated from the flexible datacenters 220 by switch 242B.

[0094] In a preferred embodiment, as illustrated, power generation equipment 210 supplies BTM power via connector 242 to flexible datacenters 220. The BTM power used by the flexible datacenters 220 was generated by the generation station 202 and did not pass through the POI 103 or utility-scale generation-side meter 253, and is not subject to T&D charges. Power received at the flexible datacenters 220 may be received through respective power input connectors 220A. Each of the respective connectors 220A may be switched connector that can electrically isolate the respective flexible datacenter 220 from the connector 242. Power equipment 220B may be arranged between the flexible datacenters 220 and the connector 242. The power equipment 220B may include, but is not limited to, power conditioners, unit transformers, inverters, and isolation equipment. As illustrated, each flexible datacenter 220 may be served by a respective power equipment 220B. However, in another embodiment, one power equipment 220B may serve multiple flexible datacenter 220.

[0095] In one embodiment, flexible datacenters 220 may be considered BTM equipment located behind-the-meter and electrically connected to the power generation equipment 210 behind (i.e., prior to) the generation station's POI 103 with the rest of the electrical grid.

[0096] In one embodiment, BTM power produced by the power generation equipment 210 is utilized by the flexible datacenters 220 behind (i.e., prior to) the generation station's POI with an electrical grid.

[0097] In another embodiment, flexible datacenters 220 may be considered BTM equipment located behind-the-meter as the flexible datacenters 220 are electrically connected to the generation station 202, and generation station 202 is subject to metering by utility-scale generation-side meter 253 (or 253A, or another utility-scale generation-side meter), and the flexible datacenters 220 receive power from the generation station 202, but the power received by the flexible datacenters 220 from the generation station 202 has not passed through a utility-scale generation-side meter. In this embodiment, the utility-scale generation-side meter 253 (or 253A) for the generation station 202 is located at the generation station's 202 POI 103. In another embodiment, the utility-scale generation-side meter for the generation station 202 is at a location other than the POI for the generation station 202 – for example, a substation (not shown) between the generation station 202 and the generation station's POI 103.

[0098] In another embodiment, power from the generation station 202 is supplied to the flexible datacenters 220 as BTM power, where power produced at the generation station 202 is subject to metering by utility-scale generation-side meter 253 (or 253A, or another utility-scale generation-side meter), but the BTM power supplied to the flexible datacenters 220 is utilized before being metered at the utility-scale generation-side meter 253 (or 253A, or another utility-scale generation-side meter). In this embodiment, the utility-scale generation-side meter 253 (or 253A) for the generation station 202 is located at the generation station's 202 POI 103. In another embodiment, the utility-scale generation-side meter for the generation station 202 is at a location other than the POI for the generation station 202 – for example, a substation (not shown) between the generation station 202 and the generation station's POI 103.

[0099] In another embodiment, flexible datacenters 220 may be considered BTM equipment located behind-the-meter as they are electrically connected to the generation station 202 that supplies power to the grid, and the flexible datacenters 220 receive power from the generation station 202 that is not subject to T&D charges, but power otherwise received from the grid that is supplied by the generation station 202 is subject to T&D charges.

[0100] In another embodiment, power from the generation station 202 is supplied to the flexible datacenters 220 as BTM power, where electrical power is generated at the generation station 202 that supplies power to a grid, and the generated power is not subject to T&D charges before being used by flexible datacenters 220, but power otherwise received from the connected grid is subject to T&D charges.

[0101] In another embodiment, flexible datacenters 220 may be considered BTM equipment located behind-the-meter because they receive power generated from the generation station 202 intended for the grid, and that received power is not routed through the electrical grid before being delivered to the flexible datacenters 220.

[0102] In another embodiment, power from the generation station 202 is supplied to the flexible datacenters 220 as BTM power, where electrical power is generated at the generation station 202 for distribution to the grid, and the flexible datacenters 220 receive that power, and that received power is not routed through the electrical grid before being delivered to the flexible datacenters 220.

[0103] In another embodiment, metered grid power may alternatively or additionally be used to power one or more of the flexible datacenters 220, or a portion within one or more of the flexible datacenters 220. As illustrated here for simplicity, metered grid power from a distribution network, such as distribution network 206, may be used to power one or more

flexible datacenters 220 over connector 256A and/or 256B. Each of connector 256A and/or 256B may be a switched connector so that metered grid power to the flexible datacenters 220 can be switched on or off as needed. More commonly, metered grid power would be delivered to the flexible datacenters 220 via a separate distribution network (not shown), and also over switched connectors. Any such grid power delivered to the flexible datacenters 220 is metered by customer meters 206A and subject to T&D costs. In one embodiment, connector 256B may supply metered grid power to a portion of one or more flexible datacenters 220. For example, connector 256B may supply metered grid power to control and/or communication systems for the flexible datacenters 220 that need constant power and cannot be subject to intermittent BTM power. Connector 242 may supply solely BTM power from the generation station 202 to high power demand computing systems within the flexible datacenters 220, in which case at least a portion of each flexible datacenters 220 so connected is operating as a BTM load. In another embodiment, connector 256A and/or 256B may supply all power used at one or more of the flexible datacenters 220, in which case each of the flexible datacenters 220 so connected would not be operating as a BTM load.

[0104] In another embodiment, when power generation equipment 210 is in an idle or off state and not generating power, grid power may backfeed into generation station 202 through POI 103 and such grid power may power the flexible datacenters 220.

[0105] The flexible datacenters 220 are shown in an example arrangement relative to the generation station 202. Particularly, generated power from the generation station 202 may be supplied to the flexible datacenters 220 through a series of connectors and/or busses (e.g., 232B, 240B, 242, 220A). As illustrated, in other embodiments, connectors between the power generation equipment 210 and other components may be switched open or closed, allowing other pathways for power transfer between the power generation equipment 210 and components, including the flexible datacenters 220. Additionally, the connector arrangement shown is illustrative only and other circuit arrangements are contemplated within the scope of supplying BTM power to a BTM load at generation station 202. For example, there may be more or fewer transformers, or one or more of transformers 212, 213, 214 may be transformer systems with multiple steppings and/or may include additional power equipment including but not limited to power conditioners, filters, switches, inverters, and/or AC/DC-DC/AC isolators. As another example, metered grid power connections to flexible datacenters 220 are shown via both 256A and 256B; however, a single connection may connect one or more flexible datacenters 220 (or power equipment 220B) to metered grid power and the one or more flexible datacenters 220 (or power equipment 220B) may include switching apparatus

to direct BTM power and/or metered grid power to control systems, communication systems, and/or computing systems as desired.

[0106] In some examples, BTM power may arrive at the flexible datacenters 220 in a three-phase AC format. As such, power equipment (e.g., power equipment 220B) at one or more of the flexible datacenters 220 may enable each flexible datacenter 220 to use one or more phases of the power. For instance, the flexible datacenters 220 may utilize power equipment (e.g., power equipment 220B, or alternatively or additionally power equipment that is part of the flexible datacenter 220) to convert BTM power received from the generation station 202 for use at computing systems at each flexible datacenter 220. In other examples, the BTM power may arrive at one or more of the flexible datacenters 220 as DC power. As such, the flexible datacenters 220 may use the DC power to power computing systems. In some such examples, the DC power may be routed through a DC-to-DC converter that is part of power equipment 220B and/or flexibles datacenter 220.

[0107] In some configurations, a flexible datacenter 220 may be arranged to only have access to power received behind-the-meter from a generation station 202. In the arrangement of Figure 2, the flexible datacenters 220 may be arranged only with a connection to the generation station 202 and depend solely on power received behind-the-meter from the generation station 202. Alternatively or additionally, the flexible datacenters 220 may receive power from energy storage system 218.

[0108] In some configurations, one or more of the flexible datacenters 220 can be arranged to have connections to multiple sources that are capable of supplying power to a flexible datacenter 220. To illustrate a first example, the flexible datacenters 220 are shown connected to connector 242, which can be connected or disconnected via switches to the energy storage system 218 via connector 218A, the generation station 202 via bus 240B, and grid power via metered connector 256A. In one embodiment, the flexible datacenters 220 may selectively use power received behind-the-meter from the generation station 202, stored power supplied by the energy storage system 218, and/or grid power. For instance, flexible datacenters 220 may use power stored in the energy storage system 218 when costs for using power supplied behind-the-meter from the generation station 202 are disadvantageous. By having access to the energy storage system 218 available, the flexible datacenters 220 may use the stored power and allow the generation station 202 to subsequently refill the energy storage system 218 when cost for power behind-the-meter is low. Alternatively, the flexible datacenters 220 may use power from multiple sources simultaneously to power different components (e.g., a first set and a second set of computing systems). Thus, the flexible

datacenters 220 may leverage the multiple connections in a manner that can reduce the cost for power used by the computing systems at the flexible datacenters 220. The flexible datacenters 220 control system or the remote master control system 262 may monitor power conditions and other factors to determine whether the flexible datacenters 220 should use power from either the generation station 202, grid power, the energy storage system 218, none of the sources, or a subset of sources during a given time range. Other arrangements are possible as well. For example, the arrangement of Figure 2 illustrates each flexible datacenter 220 as connected via a single connector 242 to energy storage system 218, generation station 202, and metered grid power via 256A. However, one or more flexible datacenters 220 may have independent switched connections to each energy source, allowing the one or more flexible datacenters 220 to operate from different energy sources than other flexible datacenters 220 at the same time.

[0109] The selection of which power source to use at a flexible datacenter (e.g., the flexible datacenters 220) or another type of BTM load can change based on various factors, such as the cost and availability of power from both sources, the type of computing systems using the power at the flexible datacenters 220 (e.g., some systems may require a reliable source of power for a long period), the nature of the computational operations being performed at the flexible datacenters 220 (e.g., a high priority task may require immediate completion regardless of cost), and temperature and weather conditions, among other possible factors. As such, a datacenter control system at the flexible datacenters 220, the remote master control system 262, or another entity (e.g., an operator at the generation station 202) may also influence and/or determine the source of power that the flexible datacenters 220 use at a given time to complete computational operations.

[0110] In some example embodiments, the flexible datacenters 220 may use power from the different sources to serve different purposes. For example, the flexible datacenters 220 may use metered power from grid power to power one or more systems at the flexible datacenters 220 that are configured to be always-on (or almost always on), such as a control and/or communication system and/or one or more computing systems (e.g., a set of computing systems performing highly important computational operations). The flexible datacenters 220 may use BTM power to power other components within the flexible datacenters 220, such as one or more computing systems that perform less critical computational operations.

[0111] In some examples, one or more flexible datacenters 220 may be deployed at the generation station 202. In other examples, flexible datacenters 220 may be deployed at a

location geographically remote from the generation station 202, while still maintaining a BTM power connection to the generation station 202.

[0112] In another example arrangement, the generation station 202 may be connected to a first BTM load (e.g., a flexible datacenter 220) and may supply power to additional BTM loads via connections between the first BTM load and the additional BTM loads (e.g., a connection between a flexible datacenter 220 and another flexible datacenter 220).

[0113] The arrangement in Figure 2, and components included therein, are for non-limiting illustration purposes and other arrangements are contemplated in examples. For instance, in another example embodiment, the arrangement of Figure 2 may include more or fewer components, such as more BTM loads, different connections between power sources and loads, and/or a different number of datacenters. In addition, some examples may involve one or more components within the arrangement of Figure 2 being combined or further divided.

[0114] Within the arrangement of Figure 2, a control system, such as the remote master control system 262 or another component (e.g., a control system associated with the grid operator, the generation station control system 216, or a datacenter control system associated with a traditional datacenter or one or more flexible datacenters) may use information to efficiently manage various operations of some of the components within the arrangement of Figure 2. For example, the remote master control system 262 or another component may manage distribution and execution of computational operations at one or more traditional datacenters 260 and/or flexible datacenters 220 via one or more information-processing algorithms. These algorithms may utilize past and current information in real-time to manage operations of the different components. These algorithms may also make some predictions based on past trends and information analysis. In some examples, multiple computing systems may operate as a network to process information.

[0115] Information used to make decisions may include economic and/or power-related information, such as monitored power system conditions. Monitored power system conditions may include one or more of excess power generation at a generation station 202, excess power at a generation station 202 that a connected grid cannot receive, power generation at a generation station 202 subject to economic curtailment, power generation at a generation station 202 subject to reliability curtailment, power generation at a generation station 202 subject to power factor correction, low power generation at a generation station 202, start up conditions at a generation station 202, transient power generation conditions at a generation station 202, or testing conditions where there is an economic advantage to using

behind-the-meter power generation at a generation station 202. These different monitored power system conditions can be weighted differently during processing and analysis.

[0116] In some examples, the information can include the cost for power from available sources (e.g., BTM power at the generation station 202 versus metered grid power) to enable comparisons to be made which power source costs less. In some instances, the information may include historic prices for power to enable the remote master control system 262 or another system to predict potential future prices in similar situations (e.g., the cost of power tends to trend upwards for grid power during warmer weather and peak-use hours). The information may also indicate the availability of power from the various sources (e.g., BTM power at the generation station 262, the energy storage system 218 at the generation station 262, and/or metered grid power).

[0117] In addition, the information may also include other data, including information associated with operations at components within the arrangement. For instance, the information may include data associated with performance of operations at the flexible datacenters 220 and the traditional datacenters 260, such as the number of computational tasks currently being performed, the types of tasks being performed (e.g., type of computational operation, time-sensitivity, etc.), the number, types, and capabilities of available computing systems, the amount of computational tasks awaiting performance, and the types of computing systems at one or more datacenters, among others. The information may also include data specifying the conditions at one or more datacenters (e.g., whether or not the temperatures are in a desired range, the amount of power available within an energy storage system such as 218), the amount of computational tasks awaiting performance in the queue of one or more of the datacenters, and the identities of the entities associated with the computational operations at one or more of the datacenters. Entities associated with computational operations may be, for example, owners of the datacenters, customers who purchase computational time at the datacenters, or other entities.

[0118] The information used by the remote master control system 262 or another component may include data associated with the computational operations to be performed, such as deadlines, priorities (e.g., high vs. low priority tasks), cost to perform based on required computing systems, the optimal computing systems (e.g., CPU vs GPU vs ASIC; processing unit capabilities, speeds, or frequencies, or instructional sets executable by the processing units) for performing each requested computational task, and prices each entity (e.g., company) is willing to pay for computational operations to be performed or otherwise supported via computing systems at a traditional datacenter 260 or a flexible datacenter 220,

among others. In addition, the information may also include other data (e.g., weather conditions at locations of datacenters or power sources, any emergencies associated with a datacenter or power source, or the current value of bids associated with an auction for computational tasks).

[0119] The information may be updated in-real time and used to make the different operational decisions within the arrangement of Figure 2. For instance, the information may help a component (e.g., the remote master control system 262 or a control system at a flexible datacenter 220) determine when to ramp up or ramp down power use at a flexible datacenter 220 or when to switch one or more computing systems at a flexible datacenter 220 into a low power mode or to operate at a different frequency, among other operational adjustments. The information can additionally or alternatively help a component within the arrangement of Figure 2 to determine when to transfer computational operations between computing systems or between datacenters based on various factors. In some instances, the information may also be used to determine when to temporarily stop performing a computational operation or when to perform a computational operation at multiple sites for redundancy or other reasons. The information may further be used to determine when to accept new computational operations from entities or when to temporarily suspend accepting new tasks to be performed due to lack of computing system availability.

[0120] The remote master control system 262 represents a computing system that is capable of obtaining, managing, and using the information described above to manage and oversee one or more operations within the arrangement of Figure 2. As such, the remote master control system 262 may be one or more computing systems configured to process all, or a subset of, the information described above, such as power, environment, computational characterization, and economic factors to assist with the distribution and execution of computing operations among one or more datacenters. For instance, the remote master control system 262 may be configured to obtain and delegate computational operations among one or more datacenters based on a weighted analysis of a variety of factors, including one or more of the cost and availability of power, the types and availability of the computing systems at each datacenter, current and predicted weather conditions at the different locations of flexible datacenters (e.g., flexible datacenters 220) and generation stations (e.g., generation stations 202), levels of power storage available at one or more energy storage systems (e.g., energy storage system 218), and deadlines and other attributes associated with particular computational operations, among other possible factors. As such, the analysis of information performed by the remote master control system 262 may vary within examples. For instance,

the remote master control system 262 may use real-time information to determine whether or not to route a computational operation to a particular flexible datacenter (e.g., a flexible datacenter 220) or to transition a computational operation between datacenters (e.g., from traditional datacenter 260 to a flexible datacenter 220).

[0121] As shown in Figure 2, the generation station 202 may be able to supply power to the grid and/or BTM loads such as flexible datacenters 220. With such a configuration, the generation station 202 may selectively provide power to the BTM loads and/or the grid based on economic and power availability considerations. For example, the generation station 202 may supply power to the grid when the price paid for the power exceeds a particular threshold (e.g., the power price offered by operators of the flexible datacenters 220). In some instances, the operator of a flexible datacenter and the operator of a generation station capable of supplying BTM power to the flexible datacenter may utilize a predefined arrangement (e.g., a contract) that specifies a duration and/or price range when the generation station may supply power to the flexible datacenter.

[0122] The remote master control system 262 may capable of directing one or more flexible datacenters 220 to ramp-up or ramp-down to desired power consumption levels, and/or to control cooperative action of multiple flexible datacenters by determining how to power each individual flexible datacenter 220 in accordance with operational directives.

[0123] The configuration of the remote master control system 262 can vary within examples as further discussed with respect to Figures 2, 3, and 7-9. The remote master control system 262 may operate as a single computing system or may involve a network of computing systems. Preferably, the remote master control system 262 is implemented across one or more servers in a fault-tolerant operating environment that ensures continuous uptime and connectivity by virtue of its distributed nature. Alternatively, although the remote master control system 262 is shown as a physically separate component arrangement for Figure 2, the remote master control system 262 may be combined with another component in other embodiments. To illustrate an example, the remote master control system 262 may operate as part of a flexible datacenter (e.g., a computing system or a datacenter control system of the flexible datacenter 220), including sharing components with a flexible datacenter, sharing power with a flexible datacenter, and/or being co-located with a flexible datacenter.

[0124] In addition, the remote master control system 262 may communicate with components within the arrangement of Figure 2 using various communication technologies, including wired and wireless communication technologies. For instance, the remote master control system 262 may use wired (not illustrated) or wireless communication to communicate with

datacenter control systems or other computing systems at the flexible datacenters 220 and the traditional datacenters 260. The remote master control system 262 may also communicate with entities inside or outside the arrangement of Figure 2 and other components within the arrangement of Figure 2 via wired or wireless communication. For instance, the remote master control system 262 may use wireless communication to obtain computational operations from entities seeking support for the computational operations at one or more datacenters in exchange for payment. The remote master control system 262 may communicate directly with the entities or may obtain the computational operations from the traditional datacenters 260. For instance, an entity may submit jobs (e.g., computational operations) to one or more traditional datacenters 260. The remote master control system 262 may determine that transferring one or more of the computational operations to a flexible datacenter 220 may better support the transferred computational operations. For example, the remote master control system 262 may determine that the transfer may enable the computational operations to be completed quicker and/or at a lower cost. In some examples, the remote master control system 262 may communicate with the entity to obtain approval prior to transferring the one or more computational operations.

[0125] The remote master control system 262 may also communicate with grid operators and/or an operator of generation station 202 to help determine power management strategies when distributing computational operations across the various datacenters. In addition, the remote master control system 262 may communicate with other sources, such as weather prediction systems, historical and current power price databases, and auction systems, etc.

[0126] In further examples, the remote master control system 262 or another computing system within the arrangement of Figure 2 may use wired or wireless communication to submit bids within an auction that involves a bidder (e.g., the highest bid) obtaining computational operations or other tasks to be performed. Particularly, the remote master control system 262 may use the information discussed above to develop bids to obtain computing operations for performance at available computing systems at flexible datacenters (e.g., flexible datacenters 220).

[0127] In the example arrangement shown in Figure 2, the flexible datacenters 220 represent example loads that can receive power behind-the-meter from the generation station 202. In such a configuration, the flexible datacenters 220 may obtain and utilize power behind-the-meter from the generation station 202 to perform various computational operations. Performance of a computational operation may involve one or more computing systems providing resources useful in the computational operation. For instance, the flexible

datacenters 220 may include one or more computing systems configured to store information, perform calculations and/or parallel processes, perform simulations, mine cryptocurrencies, and execute applications, among other potential tasks. The computing systems can be specialized or generic and can be arranged at each flexible datacenter 220 in a variety of ways (e.g., straight configuration, zig-zag configuration) as further discussed with respect to Figures 6A, 6B. Furthermore, although the example arrangement illustrated in Figure 2 shows configurations where flexible datacenters 220 serve as BTM loads, other types of loads can be used as BTM loads within examples.

[0128] The arrangement of Figure 2 includes the traditional datacenters 260 coupled to metered grid power. The traditional datacenters 260 using metered grid power to provide computational resources to support computational operations. One or more enterprises may assign computational operations to the traditional datacenters 260 with expectations that the datacenters reliably provide resources without interruption (i.e., non-intermittently) to support the computational operations, such as processing abilities, networking, and/or volatile storage. Similarly, one or more enterprises may also request computational operations to be performed by the flexible datacenters 220. The flexible datacenters 220 differ from the traditional datacenters 260 in that the flexible datacenters 220 are arranged and/or configured to be connected to BTM power, are expected to operate intermittently, and are expected to ramp load (and thus computational capability) up or down regularly in response to control directives. In some examples, the flexible datacenters 220 and the traditional datacenters 260 may have similar configurations and may only differ based on the source(s) of power relied upon to power internal computing systems. Preferably, however, the flexible datacenters 220 include particular fast load ramping abilities (e.g., quickly increase or decrease power usage) and are intended and designed to effectively operate during intermittent periods of time.

[0129] Figure 3 shows a block diagram of the remote master control system 300 according to one or more example embodiments. Remote master control system 262 may take the form of remote master control system 300, or may include less than all components in remote master control system 300, different components than in remote master control system 300, and/or more components than in remote master control system 300.

[0130] The remote master control system 300 may perform one or more operations described herein and may include a processor 302, a data storage unit 304, a communication interface 306, a user interface 308, an operations and environment analysis module 310, and a queue system 312. In other examples, the remote master control system 300 may include more or fewer components in other possible arrangements.

[0131] As shown in Figure 3, the various components of the remote master control system 300 can be connected via one or more connection mechanisms (e.g., a connection mechanism 314). In this disclosure, the term "connection mechanism" means a mechanism that facilitates communication between two or more devices, systems, components, or other entities. For instance, a connection mechanism can be a simple mechanism, such as a cable, PCB trace, or system bus, or a relatively complex mechanism, such as a packet-based communication network (e.g., LAN, WAN, and/or the Internet). In some instances, a connection mechanism can include a non-tangible medium (e.g., where the connection is wireless).

[0132] As part of the arrangement of Figure 2, the remote master control system 300 (corresponding to remote master control system 262) may perform a variety of operations, such as management and distribution of computational operations among datacenters, monitoring operational, economic, and environment conditions, and power management. For instance, the remote master control system 300 may obtain computational operations from one or more enterprises for performance at one or more datacenters. The remote master control system 300 may subsequently use information to distribute and assign the computational operations to one or more datacenters (e.g., the flexible datacenters 220) that have the resources (e.g., particular types of computing systems and available power) available to complete the computational operations. In some examples, the remote master control system 300 may assign all incoming computational operation requests to the queue system 312 and subsequently assign the queued requests to computing systems based on an analysis of current market and power conditions.

[0133] Although the remote master control system 300 is shown as a single entity, a network of computing systems may perform the operations of the remote master control system 300 in some examples. For example, the remote master control system 300 may exist in the form of computing systems (e.g., datacenter control systems) distributed across multiple datacenters.

[0134] The remote master control system 300 may include one or more processors 302. As such, the processor 302 may represent one or more general-purpose processors (e.g., a microprocessor) and/or one or more special-purpose processors (e.g., a digital signal processor (DSP)). In some examples, the processor 302 may include a combination of processors within examples. The processor 302 may perform operations, including processing data received from the other components within the arrangement of Figure 2 and data obtained from external sources, including information such as weather forecasting systems, power market price systems, and other types of sources or databases.

[0135] The data storage unit 304 may include one or more volatile, non-volatile, removable, and/or non-removable storage components, such as magnetic, optical, or flash storage, and/or can be integrated in whole or in part with the processor 302. As such, the data storage unit 304 may take the form of a non-transitory computer-readable storage medium, having stored thereon program instructions (e.g., compiled or non-compiled program logic and/or machine code) that, when executed by the processor 302, cause the remote master control system 300 to perform one or more acts and/or functions, such as those described in this disclosure. Such program instructions can define and/or be part of a discrete software application. In some instances, the remote master control system 300 can execute program instructions in response to receiving an input, such as from the communication interface 306, the user interface 308, or the operations and environment analysis module 310. The data storage unit 304 may also store other information, such as those types described in this disclosure.

[0136] In some examples, the data storage unit 304 may serve as storage for information obtained from one or more external sources. For example, data storage unit 304 may store information obtained from one or more of the traditional datacenters 260, a generation station 202, a system associated with the grid, and flexible datacenters 220. As examples only, data storage 304 may include, in whole or in part, local storage, dedicated server-managed storage, network attached storage, and/or cloud-based storage, and/or combinations thereof.

[0137] The communication interface 306 can allow the remote master control system 300 to connect to and/or communicate with another component according to one or more protocols. For instance, the communication interface 306 may be used to obtain information related to current, future, and past prices for power, power availability, current and predicted weather conditions, and information regarding the different datacenters (e.g., current workloads at datacenters, types of computing systems available within datacenters, price to obtain power at each datacenter, levels of power storage available and accessible at each datacenter, etc.). In an example, the communication interface 306 can include a wired interface, such as an Ethernet interface or a high-definition serial-digital-interface (HD-SDI). In another example, the communication interface 406 can include a wireless interface, such as a cellular, satellite, WiMAX, or WI-FI interface. A connection can be a direct connection or an indirect connection, the latter being a connection that passes through and/or traverses one or more components, such as such as a router, switcher, or other network device. Likewise, a wireless transmission can be a direct transmission or an indirect transmission. The communication interface 306 may also utilize other types of wireless communication to enable communication with datacenters positioned at various locations.

[0138] The communication interface 306 may enable the remote master control system 300 to communicate with the components of the arrangement of Figure 2. In addition, the communication interface 306 may also be used to communicate with the various datacenters, power sources, and different enterprises submitting computational operations for the datacenters to support.

[0139] The user interface 308 can facilitate interaction between the remote master control system 300 and an administrator or user, if applicable. As such, the user interface 308 can include input components such as a keyboard, a keypad, a mouse, a touch-sensitive panel, a microphone, and/or a camera, and/or output components such as a display device (which, for example, can be combined with a touch-sensitive panel), a sound speaker, and/or a haptic feedback system. More generally, the user interface 308 can include hardware and/or software components that facilitate interaction between remote master control system 300 and the user of the system.

[0140] In some examples, the user interface 308 may enable the manual examination and/or manipulation of components within the arrangement of Figure 2. For instance, an administrator or user may use the user interface 308 to check the status of, or change, one or more computational operations, the performance or power consumption at one or more datacenters, the number of tasks remaining within the queue system 312, and other operations. As such, the user interface 308 may provide remote connectivity to one or more systems within the arrangement of Figure 2.

[0141] The operations and environment analysis module 310 represents a component of the remote master control system 300 associated with obtaining and analyzing information to develop instructions/directives for components within the arrangement of Figure 2. The information analyzed by the operations and environment analysis module 310 can vary within examples and may include the information described above with respect predicting and/or directing the use of BTM power. For instance, the operations and environment analysis module 310 may obtain and access information related to the current power state of computing systems operating as part of the flexible datacenters 220 and other datacenters that the remote master control system 300 has access to. This information may be used to determine when to adjust power usage or mode of one or more computing systems. In addition, the remote master control system 300 may provide instructions a flexible datacenter 220 to cause a subset of the computing systems to transition into a low power mode to consume less power while still performing operations at a slower rate. The remote master control system 300 may also use power state information to cause a set of computing systems

at a flexible datacenter 220 to operate at a higher power consumption mode. In addition, the remote master control system 300 may transition computing systems into sleep states or power on/off based on information analyzed by the operations and environment analysis module 310.

[0142] In some examples, the operations and environment analysis module 310 may use location, weather, activity levels at the flexible datacenters or the generation station, and power cost information to determine control strategies for one or more components in the arrangement of Figure 2. For instance, the remote master control system 300 may use location information for one or more datacenters to anticipate potential weather conditions that could impact access to power. In addition, the operations and environment analysis module 310 may assist the remote master control system 300 determine whether to transfer computational operations between datacenters based on various economic and power factors.

[0143] The queue system 312 represents a queue capable of organizing computational operations to be performed by one or more datacenters. Upon receiving a request to perform a computational operation, the remote master control system 300 may assign the computational operation to the queue until one or more computing systems are available to support the computational operation. The queue system 312 may be used for organizing and transferring computational tasks in real time.

[0144] The organizational design of the queue system 312 may vary within examples. In some examples, the queue system 312 may organize indications (e.g., tags, pointers) to sets of computational operations requested by various enterprises. The queue system 312 may operate as a First-In-First-Out (FIFO) data structure. In a FIFO data structure, the first element added to the queue will be the first one to be removed. As such, the queue system 312 may include one or more queues that operate using the FIFO data structure.

[0145] In some examples, one or more queues within the queue system 312 may use other designs of queues, including rules to rank or organize queues in a particular manner that can prioritize some sets of computational operations over others. The rules may include one or more of an estimated cost and/or revenue to perform each set of computational operations, an importance assigned to each set of computational operations, and deadlines for initiating or completing each set of computational operations, among others. Examples using a queue system are further described below with respect to Figure 9.

[0146] In some examples, the remote master control system 300 may be configured to monitor one or more auctions to obtain computational operations for datacenters to support. Particularly, the remote master control system 300 may use resource availability and power

prices to develop and submit bids to an external or internal auction system for the right to support particular computational operations. As a result, the remote master control system 300 may identify computational operations that could be supported at one or more flexible datacenters 220 at low costs.

[0147] Figure 4 is a block diagram of a generation station 400, according to one or more example embodiments. Generation station 202 may take the form of generation station 400, or may include less than all components in generation station 400, different components than in generation station 400, and/or more components than in generation station 400. The generation station 400 includes power generation equipment 401, a communication interface 408, a behind-the-meter interface 406, a grid interface 404, a user interface 410, a generation station control system 414, and power transformation equipment 402. The power generation equipment 210 may take the form of power generation equipment 401, or may include less than all components in power generation equipment 401, different components than in power generation equipment 401, and/or more components than in power generation equipment 401. Generation station control system 216 may take the form of generation station control system 414, or may include less than all components in generation station control system 414, different components than in generation station control system 414, and/or more components than in generation station control system 414. Some or all of the components generation station 400 may be connected via a communication interface 516. These components are illustrated in Figure 4 to convey an example configuration for the generation station 400 (corresponding to generation station 202 shown in Figure 2). In other examples, the generation station 400 may include more or fewer components in other arrangements.

[0148] The generation station 400 can correspond to any type of grid-connected utility-scale power producer capable of supplying power to one or more loads. The size, amount of power generated, and other characteristics of the generation station 400 may differ within examples. For instance, the generation station 400 may be a power producer that provides power intermittently. The power generation may depend on monitored power conditions, such as weather at the location of the generation station 400 and other possible conditions. As such, the generation station 400 may be a temporary arrangement, or a permanent facility, configured to supply power. The generation station 400 may supply BTM power to one or more loads and supply metered power to the electrical grid. Particularly, the generation station 400 may supply power to the grid as shown in the arrangement of Figure 2.

[0149] The power generation equipment 401 represents the component or components configured to generate utility-scale power. As such, the power generation equipment 401

may depend on the type of facility that the generation station 400 corresponds to. For instance, the power generation equipment 401 may correspond to electric generators that transform kinetic energy into electricity. The power generation equipment 401 may use electromagnetic induction to generate power. In other examples, the power generation equipment 401 may utilize electrochemistry to transform chemical energy into power. The power generation equipment 401 may use the photovoltaic effect to transform light into electrical energy. In some examples, the power generation equipment 401 may use turbines to generate power. The turbines may be driven by, for example, wind, water, steam or burning gas. Other examples of power production are possible.

[0150] The communication interface 408 can enable the generation station 400 to communicate with other components within the arrangement of Figure 2. As such, the communication interface 408 may operate similarly to the communication interface 306 of the remote master control system 300 and the communication interface 503 of the flexible datacenter 500.

[0151] The generation station control system 414 may be one or more computing systems configured to control various aspects of the generation station 400.

[0152] The BTM interface 406 is a module configured to enable the power generation equipment 401 to supply BTM power to one or more loads and may include multiple components. The arrangement of the BTM interface 406 may differ within examples based on various factors, such as the number of flexible datacenters 220 (or 500) coupled to the generation station 400, the proximity of the flexible datacenters 220 (or 500), and the type of generation station 400, among others. In some examples, the BTM interface 406 may be configured to enable power delivery to one or more flexible datacenters positioned near the generation station 400. Alternatively, the BTM interface 406 may also be configured to enable power delivery to one or more flexible datacenters 220 (or 500) positioned remotely from the generation station 400.

[0153] The grid interface 404 is a module configured to enable the power generation equipment 401 to supply power to the grid and may include multiple components. As such, the grid interface 404 may couple to one or more transmission lines (e.g., transmission lines 404a shown in Figure 2) to enable delivery of power to the grid.

[0154] The user interface 410 represents an interface that enables administrators and/or other entities to communicate with the generation station 400. As such, the user interface 410 may have a configuration that resembles the configuration of the user interface 308 shown in

Figure 3. An operator may utilize the user interface 410 to control or monitor operations at the generation station 400.

[0155] The power transformation equipment 402 represents equipment that can be utilized to enable power delivery from the power generation equipment 401 to the loads and to transmission lines linked to the grid. Example power transformation equipment 402 includes, but is not limited to, transformers, inverters, phase converters, and power conditioners.

[0156] Figure 5 shows a block diagram of a flexible datacenter 500, according to one or more example embodiments. Flexible datacenters 220 may take the form of flexible datacenter 500, or may include less than all components in flexible datacenter 500, different components than in flexible datacenter 500, and/or more components than in flexible datacenter 500. In the example embodiment shown in Figure 5, the flexible datacenter 500 includes a power input system 502, a communication interface 503, a datacenter control system 504, a power distribution system 506, a climate control system 508, one or more sets of computing systems 512, and a queue system 514. These components are shown connected by a communication bus 528. In other embodiments, the configuration of flexible datacenter 500 can differ, including more or fewer components. In addition, the components within flexible datacenter 500 may be combined or further divided into additional components within other embodiments.

[0157] The example configuration shown in Figure 5 represents one possible configuration for a flexible datacenter. As such, each flexible datacenter may have a different configuration when implemented based on a variety of factors that may influence its design, such as location and temperature that the location, particular uses for the flexible datacenter, source of power supplying computing systems within the flexible datacenter, design influence from an entity (or entities) that implements the flexible datacenter, and space available for the flexible datacenter. Thus, the embodiment of flexible datacenter 220 shown in Figure 2 represents one possible configuration for a flexible datacenter out of many other possible configurations.

[0158] The flexible datacenter 500 may include a design that allows for temporary and/or rapid deployment, setup, and start time for supporting computational operations. For instance, the flexible datacenter 500 may be rapidly deployed at a location near a source of generation station power (e.g., near a wind farm or solar farm). Rapid deployment may involve positioning the flexible datacenter 500 at a target location and installing and/or configuring one or more racks of computing systems within. The racks may include wheels to enable swift movement of the computing systems. Although the flexible datacenter 500

could theoretically be placed anywhere, transmission losses may be minimized by locating it proximate to BTM power generation.

[0159] The physical construction and layout of the flexible datacenter 500 can vary. In some instances, the flexible datacenter 500 may utilize a metal container (e.g., a metal container 602 shown in Figure 6A). In general, the flexible datacenter 500 may utilize some form of secure weatherproof housing designed to protect interior components from wind, weather, and intrusion. The physical construction and layout of example flexible datacenters are further described with respect to Figures 6A-6B.

[0160] Within the flexible datacenter 500, various internal components enable the flexible datacenter 500 to utilize power to perform some form of operations. The power input system 502 is a module of the flexible datacenter 500 configured to receive external power and input the power to the different components via assistance from the power distribution system 506. As discussed with respect to Figure 2, the sources of external power feeding a flexible datacenter can vary in both quantity and type (e.g., the generation stations 202, 400, grid-power, energy storage systems). Power input system 502 includes a BTM power input sub-system 522, and may additionally include other power input sub-systems (e.g., a grid-power input sub-system 524 and/or an energy storage input sub-system 526). In some instances, the quantity of power input sub-systems may depend on the size of the flexible datacenter and the number and/or type of computing systems being powered.

[0161] In some embodiments, the power input system 502 may include some or all of flexible datacenter Power Equipment 220B. The power input system 502 may be designed to obtain power in different forms (e.g., single phase or three-phase behind-the-meter alternating current ("AC") voltage, and/or direct current ("DC") voltage). As shown, the power input system 502 includes a BTM power input sub-system 522, a grid power input sub-system 524, and an energy input sub-system 526. These sub-systems are included to illustrate example power input sub-systems that the flexible datacenter 500 may utilize, but other examples are possible. In addition, in some instances, these sub-systems may be used simultaneously to supply power to components of the flexible datacenter 500. The sub-systems may also be used based on available power sources.

[0162] In some implementations, the BTM power input sub-system 522 may include one or more AC-to-AC step-down transformers used to step down supplied medium-voltage AC to low voltage AC (e.g., 120V to 600V nominal) used to power computing systems 512 and/or other components of flexible datacenter 500. The power input system 502 may also directly receive single-phase low voltage AC from a generation station as BTM power, from grid

power, or from a stored energy system such as energy storage system 218. In some implementations, the power input system 502 may provide single-phase AC voltage to the datacenter control system 504 (and/or other components of flexible datacenter 500) independent of power supplied to computing systems 512 to enable the datacenter control system 504 to perform management operations for the flexible datacenter 500. For instance, the grid power input sub-system 524 may use grid power to supply power to the datacenter control system 504 to ensure that the datacenter control system 504 can perform control operations and communicate with the remote master control system 300 (or 262) during situations when BTM power is not available. As such, the datacenter control system 504 may utilize power received from the power input system 502 to remain powered to control the operation of flexible datacenter 500, even if the computational operations performed by the computing system 512 are powered intermittently. In some instances, the datacenter control system 504 may switch into a lower power mode to utilize less power while still maintaining the ability to perform some functions.

[0163] The power distribution system 506 may distribute incoming power to the various components of the flexible datacenter 500. For instance, the power distribution system 506 may direct power (e.g., single-phase or three-phase AC) to one or more components within flexible datacenter 500. In some embodiments, the power distribution system 506 may include some or all of flexible datacenter Power Equipment 220B.

[0164] In some examples, the power input system 502 may provide three phases of three-phase AC voltage to the power distribution system 506. The power distribution system 506 may controllably provide a single phase of AC voltage to each computing system or groups of computing systems 512 disposed within the flexible datacenter 500. The datacenter control system 504 may controllably select which phase of three-phase nominal AC voltage that power distribution system 506 provides to each computing system 512 or groups of computing systems 512. This is one example manner in which the datacenter control system 504 may modulate power delivery (and load at the flexible datacenter 500) by ramping-up flexible datacenter 500 to fully operational status, ramping-down flexible datacenter 500 to offline status (where only datacenter control system 504 remains powered), reducing load by withdrawing power delivery from, or reducing power to, one or more of the computing systems 512 or groups of the computing systems 512, or modulating power factor correction for the generation station 300 (or 202) by controllably adjusting which phases of three-phase nominal AC voltage are used by one or more of the computing systems 512 or groups of the computing systems 512. The datacenter control system 504 may direct power to certain sets

of computing systems based on computational operations waiting for computational resources within the queue system 514. In some embodiments, the flexible datacenter 500 may receive BTM DC power to power the computing systems 512.

[0165] One of ordinary skill in the art will recognize that a voltage level of three-phase AC voltage may vary based on an application or design and the type or kind of local power generation. As such, a type, kind, or configuration of the operational AC-to-AC step down transformer (not shown) may vary based on the application or design. In addition, the frequency and voltage level of three-phase AC voltage, single-phase AC voltage, and DC voltage may vary based on the application or design in accordance with one or more embodiments.

[0166] As discussed above, the datacenter control system 504 may perform operations described herein, such as dynamically modulating power delivery to one or more of the computing systems 512 disposed within flexible datacenter 500. For instance, the datacenter control system 504 may modulate power delivery to one or more of the computing systems 512 based on various factors, such as BTM power availability or an operational directive from a generation station 262 or 300 control system, a remote master control system 262 or 300, or a grid operator. In some examples, the datacenter control system 504 may provide computational operations to sets of computing systems 512 and modulate power delivery based on priorities assigned to the computational operations. For instance, an important computational operation (e.g., based on a deadline for execution and/or price paid by an entity) may be assigned to a particular computing system or set of computing systems 512 that has the capacity, computational abilities to support the computational operation. In addition, the datacenter control system 504 may also prioritize power delivery to the computing system or set of computing systems 512.

[0167] In some example, the datacenter control system 504 may further provide directives to one or more computing systems to change operations in some manner. For instance, the datacenter control system 504 may cause one or more computing systems 512 to operate at a lower or higher frequency, change clock cycles, or operate in a different power consumption mode (e.g., a low power mode). These abilities may vary depending on types of computing systems 512 available at the flexible datacenter 500. As a result, the datacenter control system 504 may be configured to analyze the computing systems 512 available either on a periodic basis (e.g., during initial set up of the flexible datacenter 500) or in another manner (e.g., when a new computational operation is assigned to the flexible datacenter 500).

[0168] The datacenter control system 504 may also implement directives received from the remote master control system 262 or 300. For instance, the remote master control system 262 or 300 may direct the flexible datacenter 500 to switch into a low power mode. As a result, one or more of the computing systems 512 and other components may switch to the low power mode in response.

[0169] The datacenter control system 504 may utilize the communication interface 503 to communicate with the remote master control system 262 or 300, other datacenter control systems of other datacenters, and other entities. As such, the communication interface 503 may include components and operate similar to the communication interface 306 of the remote master control system 300 described with respect to Figure 4.

[0170] The flexible datacenter 500 may also include a climate control system 508 to maintain computing systems 512 within a desired operational temperature range. The climate control system 508 may include various components, such as one or more air intake components, an evaporative cooling system, one or more fans, an immersive cooling system, an air conditioning or refrigerant cooling system, and one or more air outtake components. One of ordinary skill in the art will recognize that any suitable heat extraction system configured to maintain the operation of computing systems 512 within the desired operational temperature range may be used.

[0171] The flexible datacenter 500 may further include an energy storage system 510. The energy storage system 510 may store energy for subsequent use by computing systems 512 and other components of flexible datacenter 500. For instance, the energy storage system 510 may include a battery system. The battery system may be configured to convert AC voltage to DC voltage and store power in one or more storage cells. In some instances, the battery system may include a DC-to-AC inverter configured to convert DC voltage to AC voltage, and may further include an AC phase-converter, to provide AC voltage for use by flexible datacenter 500.

[0172] The energy storage system 510 may be configured to serve as a backup source of power for the flexible datacenter 500. For instance, the energy storage system 510 may receive and retain power from a BTM power source at a low cost (or no cost at all). This low-cost power can then be used by the flexible datacenter 500 at a subsequent point, such as when BTM power costs more. Similarly, the energy storage system 510 may also store energy from other sources (e.g., grid power). As such, the energy storage system 510 may be configured to use one or more of the sub-systems of the power input system 502.

[0173] In some examples, the energy storage system 510 may be external to the flexible datacenter 500. For instance, the energy storage system 510 may be an external source that multiple flexible datacenters utilize for back-up power.

[0174] The computing systems 512 represent various types of computing systems configured to perform computational operations. Performance of computational operations include a variety of tasks that one or more computing systems may perform, such as data storage, calculations, application processing, parallel processing, data manipulation, cryptocurrency mining, and maintenance of a distributed ledger, among others. As shown in Figure 5, the computing systems 512 may include one or more CPUs 516, one or more GPUs 518, and/or one or more Application-Specific Integrated Circuits (ASIC's) 520. Each type of computing system 512 may be configured to perform particular operations or types of operations.

[0175] Due to different performance features and abilities associated with the different types of computing systems, the datacenter control system 504 may determine, maintain, and/or relay this information about the types and/or abilities of the computing systems, quantity of each type, and availability to the remote master control system 262 or 300 on a routine basis (e.g., periodically or on-demand). This way, the remote master control system 262 or 300 may have current information about the abilities of the computing systems 512 when distributing computational operations for performance at one or more flexible datacenters. Particularly, the remote master control system 262 or 300 may assign computational operations based on various factors, such as the types of computing systems available and the type of computing systems required by each computing operation, the availability of the computing systems, whether computing systems can operate in a low power mode, and/or power consumption and/or costs associated with operating the computing systems, among others.

[0176] The quantity and arrangement of these computing systems 512 may vary within examples. In some examples, the configuration and quantity of computing systems 512 may depend on various factors, such as the computational tasks that are performed by the flexible datacenter 500. In other examples, the computing systems 512 may include other types of computing systems as well, such as DSPs, SIMDs, neural processors, and/or quantum processors.

[0177] As indicated above, the computing systems 512 can perform various computational operations, including in different configurations. For instance, each computing system may perform a particular computational operation unrelated to the operations performed at other

computing systems. Groups of the computing systems 512 may also be used to work together to perform computational operations.

[0178] In some examples, multiple computing systems may perform the same computational operation in a redundant configuration. This redundant configuration creates a back-up that prevents losing progress on the computational operation in situations of a computing failure or intermittent operation of one or more computing systems. In addition, the computing systems 512 may also perform computational operations using a check point system. The check point system may enable a first computing system to perform operations up to a certain point (e.g., a checkpoint) and switch to a second computing system to continue performing the operations from that certain point. The check point system may also enable the datacenter control system 504 to communicate statuses of computational operations to the remote master control system 262 or 300. This can further enable the remote master control system 262 300 to transfer computational operations between different flexible datacenters allowing computing systems at the different flexible datacenters to resume support of computational operations based on the check points.

[0179] The queue system 514 may operate similar to the queue system 312 of the remote master control system 300 shown in Figure 3. Particularly, the queue system 514 may help store and organize computational tasks assigned for performance at the flexible datacenter 500. In some examples, the queue system 514 may be part of a distributed queue system such that each flexible datacenter in a fleet of flexible datacenter includes a queue, and each queue system 514 may be able to communicate with other queue systems. In addition, the remote master control system 262 or 300 may be configured to assign computational tasks to the queues located at each flexible datacenter (e.g., the queue system 514 of the flexible datacenter 500). As such, communication between the remote master control system 262 or 300 and the datacenter control system 504 and/or the queue system 514 may allow organization of computational operations for the flexible datacenter 500 to support.

[0180] Figure 6A shows another structural arrangement for a flexible datacenter, according to one or more example embodiments. The particular structural arrangement shown in Figure 6A may be implemented at flexible datacenter 500. The illustration depicts the flexible datacenter 500 as a mobile container 702 equipped with the power input system 502, the power distribution system 506, the climate control system 508, the datacenter control system 504, and the computing systems 512 arranged on one or more racks 604. These components of flexible datacenter 500 may be arranged and organized according to an example structural

region arrangement. As such, the example illustration represents one possible configuration for the flexible datacenter 500, but others are possible within examples.

[0181] As discussed above, the structural arrangement of the flexible datacenter 500 may depend on various factors, such as the ability to maintain temperature within the mobile container 602 within a desired temperature range. The desired temperature range may depend on the geographical location of the mobile container 602 and the type and quantity of the computing systems 512 operating within the flexible datacenter 500 as well as other possible factors. As such, the different design elements of the mobile container 602 including the inner contents and positioning of components may depend on factors that aim to maximize the use of space within mobile container 602, lower the amount of power required to cool the computing systems 512, and make setup of the flexible datacenter 500 efficient. For instance, a first flexible datacenter positioned in a cooler geographic region may include less cooling equipment than a second flexible datacenter positioned in a warmer geographic region.

[0182] As shown in Figure 6A, the mobile container 602 may be a storage trailer disposed on permanent or removable wheels and configured for rapid deployment. In other embodiments, the mobile container 602 may be a storage container (not shown) configured for placement on the ground and potentially stacked in a vertical or horizontal manner (not shown). In still other embodiments, the mobile container 602 may be an inflatable container, a floating container, or any other type or kind of container suitable for housing a mobile flexible datacenter. As such, the flexible datacenter 500 may be rapidly deployed on site near a source of unutilized behind-the-meter power generation. And in still other embodiments, the flexible datacenter 500 might not include a mobile container. For example, the flexible datacenter 500 may be situated within a building or another type of stationary environment.

[0183] Figure 6B shows the computing systems 512 in a straight-line configuration for installation within the flexible datacenter 500, according to one or more example embodiments. As indicated above, the flexible datacenter 500 may include a plurality of racks 604, each of which may include one or more computing systems 512 disposed therein. As discussed above, the power input system 502 may provide three phases of AC voltage to the power distribution system 506. In some examples, the power distribution system 506 may controllably provide a single phase of AC voltage to each computing system 512 or group of computing systems 512 disposed within the flexible datacenter 500. As shown in Figure 6B, for purposes of illustration only, eighteen total racks 604 are divided into a first group of six racks 606, a second group of six racks 608, and a third group of six racks 610,

where each rack contains eighteen computing systems 512. The power distribution system (506 of Figure 5) may, for example, provide a first phase of three-phase AC voltage to the first group of six racks 606, a second phase of three-phase AC voltage to the second group of six racks 608, and a third phase of three-phase AC voltage to the third group of six racks 610. In other embodiments, the quantity of racks and computing systems can vary.

[0184] Figure 7 shows a control distribution system 700 of the flexible datacenter 500 according to one or more example embodiments. The system 700 includes a grid operator 702, a generation station control system 216, a remote master control system 300, and a flexible datacenter 500. As such, the system 700 represents one example configuration for controlling operations of the flexible datacenter 500, but other configurations may include more or fewer components in other arrangements.

[0185] The datacenter control system 504 may independently or cooperatively with one or more of the generation station control system 414, the remote master control system 300, and/or the grid operator 702 modulate power at the flexible datacenter 500. During operations, the power delivery to the flexible datacenter 500 may be dynamically adjusted based on conditions or operational directives. The conditions may correspond to economic conditions (e.g., cost for power, aspects of computational operations to be performed), power-related conditions (e.g., availability of the power, the sources offering power), demand response, and/or weather-related conditions, among others.

[0186] The generation station control system 414 may be one or more computing systems configured to control various aspects of a generation station (not independently illustrated, e.g., 216 or 400). As such, the generation station control system 414 may communicate with the remote master control system 300 over a networked connection 706 and with the datacenter control system 704 over a networked or other data connection 708.

[0187] As discussed with respect to Figures 2 and 3, the remote master control system 300 can be one or more computing systems located offsite, but connected via a network connection 710 to the datacenter control system 504. The remote master control system 300 may provide supervisory controls or override control of the flexible datacenter 500 or a fleet of flexible datacenters (not shown).

[0188] The grid operator 702 may be one or more computing systems that are configured to control various aspects of the power grid (not independently illustrated) that receives power from the generation station. The grid operator 702 may communicate with the generation station control system 300 over a networked or other data connection 712.

[0189] The datacenter control system 504 may monitor BTM power conditions at the generation station and determine when a datacenter ramp-up condition is met. The BTM power availability may include one or more of excess local power generation, excess local power generation that the grid cannot accept, local power generation that is subject to economic curtailment, local power generation that is subject to reliability curtailment, local power generation that is subject to power factor correction, conditions where the cost for power is economically viable (e.g., low cost to obtain power), low priced power, situations where local power generation is prohibitively low, start up situations, transient situations, or testing situations where there is an economic advantage to using locally generated behind-the-meter power generation, specifically power available at little to no cost and with no associated transmission or distribution losses or costs. For example, a datacenter control system may analyze future workload and near term weather conditions at the flexible datacenter.

[0190] In some instances, the datacenter ramp-up condition may be met if there is sufficient behind-the-meter power availability and there is no operational directive from the generation station control system 414, the remote master control system 300, or the grid operator 702 to go offline or reduce power. As such, the datacenter control system 504 may enable 714 the power input system 502 to provide power to the power distribution system 506 to power the computing systems 512 or a subset thereof.

[0191] The datacenter control system 504 may optionally direct one or more computing systems 512 to perform predetermined computational operations (e.g., distributed computing processes). For example, if the one or more computing systems 512 are configured to perform blockchain hashing operations, the datacenter control system 504 may direct them to perform blockchain hashing operations for a specific blockchain application, such as, for example, Bitcoin, Litecoin, or Ethereum. Alternatively, one or more computing systems 512 may be configured to perform high-throughput computing operations and/or high performance computing operations.

[0192] The remote master control system 300 may specify to the datacenter control system 504 what sufficient behind-the-meter power availability constitutes, or the datacenter control system 504 may be programmed with a predetermined preference or criteria on which to make the determination independently. For example, in certain circumstances, sufficient behind-the-meter power availability may be less than that required to fully power the entire flexible datacenter 500. In such circumstances, the datacenter control system 504 may provide power to only a subset of computing systems, or operate the plurality of computing

systems in a lower power mode, that is within the sufficient, but less than full, range of power that is available. In addition, the computing systems 512 may adjust operational frequency, such as performing more or less processes during a given duration.

[0193] While the flexible datacenter 500 is online and operational, a datacenter ramp-down condition may be met when there is insufficient or anticipated to be insufficient, behind-the-meter power availability or there is an operational directive from the generation station control system 414, the remote master control system 300, or the grid operator 702. The datacenter control system 504 may monitor and determine when there is insufficient, or anticipated to be insufficient, behind-the-meter power availability. As noted above, sufficiency may be specified by the remote master control system 300 or the datacenter control system 504 may be programmed with a predetermined preference or criteria on which to make the determination independently.

[0194] An operational directive may be based on current dispatch-ability, forward looking forecasts for when behind-the-meter power is, or is expected to be, available, economic considerations, reliability considerations, operational considerations, or the discretion of the generation station control system 414, the remote master control system 300, or the grid operator 702. For example, the generation station control system 414, the remote master control system 300, or the grid operator 702 may issue an operational directive to flexible datacenter 500 to go offline and power down. When the datacenter ramp-down condition is met, the datacenter control system 504 may disable power delivery to the plurality of computing systems (e.g., 512). The datacenter control system 504 may disable 714 the power input system 502 from providing power (e.g., three-phase nominal AC voltage) to the power distribution system 506 to power down the computing systems 512 while the datacenter control system 504 remains powered and is capable of returning service to operating mode at the flexible datacenter 500 when behind-the-meter power becomes available again.

[0195] While the flexible datacenter 500 is online and operational, changed conditions or an operational directive may cause the datacenter control system 504 to modulate power consumption by the flexible datacenter 500. The datacenter control system 504 may determine, or the generation station control system 414, the remote master control system 300, or the grid operator 702 may communicate, that a change in local conditions may result in less power generation, availability, or economic feasibility, than would be necessary to fully power the flexible datacenter 500. In such situations, the datacenter control system 504 may take steps to reduce or stop power consumption by the flexible datacenter 500 (other than that required to maintain operation of datacenter control system 504).

[0196] Alternatively, the generation station control system 414, the remote master control system 300, or the grid operator 702, may issue an operational directive to reduce power consumption for any reason, the cause of which may be unknown. In response, the datacenter control system 504 may dynamically reduce or withdraw power delivery to one or more computing systems 512 to meet the dictate. The datacenter control system 504 may controllably provide three-phase nominal AC voltage to a smaller subset of computing systems (e.g., 512) to reduce power consumption. The datacenter control system 504 may dynamically reduce the power consumption of one or more computing systems by reducing their operating frequency or forcing them into a lower power mode through a network directive.

[0197] One of ordinary skill in the art will recognize that datacenter control system 504 may be configured to have a number of different configurations, such as a number or type or kind of the computing systems 512 that may be powered, and in what operating mode, that correspond to a number of different ranges of sufficient and available behind-the-meter power. As such, the datacenter control system 504 may modulate power delivery over a variety of ranges of sufficient and available unutilized behind-the-meter power availability.

[0198] Figure 8 shows a control distribution system 800 of a fleet of flexible datacenters according to one or more example embodiments. The control distribution system 800 of the flexible datacenter 500 shown and described with respect to Figure 7 may be extended to a fleet of flexible datacenters as illustrated in Figure 8. For example, a first generation station (not independently illustrated), such as a wind farm, may include a first plurality of flexible datacenters 802, which may be collocated or distributed across the generation station. A second generation station (not independently illustrated), such as another wind farm or a solar farm, may include a second plurality of flexible datacenters 804, which may be collocated or distributed across the generation station. One of ordinary skill in the art will recognize that the number of flexible datacenters deployed at a given station and the number of stations within the fleet may vary based on an application or design in accordance with one or more example embodiments.

[0199] The remote master control system 300 may provide directive to datacenter control systems of the fleet of flexible datacenters in a similar manner to that shown and described with respect to Figure 7, with the added flexibility to make high level decisions with respect to fleet that may be counterintuitive to a given station. The remote master control system 300 may make decisions regarding the issuance of operational directives to a given generation station based on, for example, the status of each generation station where flexible datacenters

are deployed, the workload distributed across fleet, and the expected computational demand required for one or both of the expected workload and predicted power availability. In addition, the remote master control system 300 may shift workloads from the first plurality of flexible datacenters 802 to the second plurality of flexible datacenters 804 for any reason, including, for example, a loss of BTM power availability at one generation station and the availability of BTM power at another generation station. As such, the remote master control system 300 may communicate with the generation station control systems 806A, 806B to obtain information that can be used to organize and distribute computational operations to the fleets of flexible datacenters 802, 804.

[0200] Figure 9 shows a queue distribution arrangement for a traditional datacenter 902 and a flexible datacenter 500, according to one or more example embodiments. The arrangement of Figure 9 includes a flexible datacenter 500, a traditional datacenter 902, a queue system 312, a set of communication links 916, 918, 920A, 920B, and the remote master control system 300. The arrangement of Figure 9 represents an example configuration scheme that can be used to distribute computing operations using a queue system 312 between the traditional datacenter 902 and one or more flexible datacenters. In other examples, the arrangement of Figure 9 may include more or fewer components in other potential configurations. For instance, the arrangement of Figure 9 may not include the queue system 312 or may include routes that bypass the queue system 312.

[0201] The arrangement of Figure 9 may enable computational operations requested to be performed by entities (e.g., companies). As such, the arrangement of Figure 9 may use the queue system 312 to organize incoming computational operations requests to enable efficient distribution to the flexible datacenter 500 and the critical traditional datacenter 902. Particularly, the arrangement of Figure 9 may use the queue system 312 to organize sets of computational operations thereby increasing the speed of distribution and performance of the different computational operations among datacenters. As a result, the use of the queue system 312 may reduce time to complete operations and reduce costs.

[0202] In some examples, one or more components, such as the datacenter control system 504, the remote master control system 300, the queue system 312, or the control system 936, may be configured to identify situations that may arise where using the flexible datacenter 500 can reduce costs or increase productivity of the system, as compared to using the traditional datacenter 902 for computational operations. For example, a component within the arrangement of Figure 9 may identify when using behind-the-meter power to power the computing systems 512 within the flexible datacenter 500 is at a lower cost compared to

using the computing systems 934 within the traditional datacenter 902 that are powered by grid power. Additionally, a component in the arrangement of Figure 9 may be configured to determine situations when offloading computational operations from the traditional datacenter 902 indirectly (i.e., via the queue system 312) or directly (i.e., bypassing the queue system 312) to the flexible datacenter 500 can increase the performance allotted to the computational operations requested by an entity (e.g., reduce the time required to complete time-sensitive computational operations).

[0203] In some examples, the datacenter control system 504 may monitor activity of the computing systems 512 within the flexible datacenter 500 and use the respective activity levels to determine when to obtain computational operations from the queue system 312. For instance, the datacenter control system 504 may analyze various factors prior to requesting or accessing a set of computational operations or an indication of the computational operations for the computing systems 512 to perform. The various factors may include power availability at the flexible datacenter 500 (e.g., either stored or from a BTM source), availability of the computing systems 512 (e.g., percentage of computing systems available), type of computational operations available, estimated cost to perform the computational operations at the flexible datacenter 500, cost for power, cost for power relative to cost for grid power, and instructions from other components within the system, among others. The datacenter control system 504 may analyze one or more of the factors when determining whether to obtain a new set of computational operations for the computing systems 512 to perform. In such a configuration, the datacenter control system 504 manages the activity of the flexible datacenter 500, including determining when to acquire new sets of computational operations when capacity among the computing systems 512 permit.

[0204] In other examples, a component (e.g., the remote master control system 300) within the system may assign or distribute one or more sets of computational operations organized by the queue system 312 to the flexible datacenter 500. For example, the remote master control system 300 may manage the queue system 312, including the distribution of computational operations organized by the queue system 312 to the flexible datacenter 500 and the traditional datacenter 902. The remote master control system 300 may utilize to information described with respect to the Figures above to determine when to assign computational operations to the flexible datacenter 500.

[0205] The traditional datacenter 902 may include a power input system 930, a power distribution system 932, a datacenter control system 936, and a set of computing systems 934. The power input system 930 may be configured to receive power from a power grid and

distribute the power to the computing systems 934 via the power distribution system 932. The datacenter control system 936 may monitor activity of the computing systems 934 and obtain computational operations to perform from the queue system 312. The datacenter control system 936 may analyze various factors prior to requesting or accessing a set of computational operations or an indication of the computational operations for the computing systems 934 to perform. A component (e.g., the remote master control system 300) within the arrangement of Figure 9 may assign or distribute one or more sets of computational operations organized by the queue system 312 to the traditional datacenter 902.

[0206] The communication link 916 represents one or more links that may serve to connect the flexible datacenter 500, the traditional datacenter 902, and other components within the system (e.g., the remote master control system 300, the queue system 312 – connections not shown). In particular, the communication link 916 may enable direct or indirect communication between the flexible datacenter 500 and the traditional datacenter 902. The type of communication link 916 may depend on the locations of the flexible datacenter 500 and the traditional datacenter 902. Within embodiments, different types of communication links can be used, including but not limited to WAN connectivity, cloud-based connectivity, and wired and wireless communication links.

[0207] The queue system 312 represents an abstract data type capable of organizing computational operation requests received from entities. As each request for computational operations are received, the queue system 312 may organize the request in some manner for subsequent distribution to a datacenter. Different types of queues can make up the queue system 312 within embodiments. The queue system 312 may be a centralized queue that organizes all requests for computational operations. As a centralized queue, all incoming requests for computational operations may be organized by the centralized queue.

[0208] In other examples, the queue system 312 may be distributed consisting of multiple queue sub-systems. In the distributed configuration, the queue system 312 may use multiple queue sub-systems to organize different sets of computational operations. Each queue sub-system may be used to organize computational operations based on various factors, such as according to deadlines for completing each set of computational operations, locations of enterprises submitting the computational operations, economic value associated with the completion of computational operations, and quantity of computing resources required for performing each set of computational operations. For instance, a first queue sub-system may organize sets of non-intensive computational operations and a second queue sub-system may organize sets of intensive computational operations. In some examples, the queue system

312 may include queue sub-systems located at each datacenter. This way, each datacenter (e.g., via a datacenter control system) may organize computational operations obtained at the datacenter until computing systems are able to start executing the computational operations. In some examples, the queue system 312 may move computational operations between different computing systems or different datacenters in real-time.

[0209] Within the arrangement of Figure 9, the queue system 312 is shown connected to the remote master control system 300 via the communication link 918. In addition, the queue system 312 is also shown connected to the flexible datacenter via the communication 920A and to the traditional datacenter 902 via the communication link 920B. The communication links 918, 920A, 920B may be similar to the communication link 916 and can be various types of communication links within examples.

[0210] The queue system 312 may include a computing system configured to organize and maintain queues within the queue system 312. In another example, one or more other components of the system may maintain and support queues within the queue system 312. For instance, the remote master control system 300 may maintain and support the queue system 312. In other examples, multiple components may maintain and support the queue system 312 in a distributed manner, such as a blockchain configuration.

[0211] In some embodiments, the remote master control system 300 may serve as an intermediary that facilitates all communication between flexible datacenter 500 and the traditional datacenter 902. Particularly, the traditional datacenter 902 or the flexible datacenter 500 might need to transmit communications to the remote master control system 300 in order to communicate with the other datacenter. As also shown, the remote master control system 300 may connect to the queue system 312 via the communication link 918. Computational operations may be distributed between the queue system 312 and the remote master control system 300 via the communication link 918. The computational operations may be transferred in real-time and mid-performance from one datacenter to another (e.g., from the traditional datacenter 902 to the flexible datacenter 500). In addition, the remote master control system 300 may manage the queue system 312, including providing resources to support queues within the queue system 312.

[0212] As a result, the remote master control system 300 may offload some or all of the computational operations assigned to the traditional datacenter 902 to the flexible datacenter 500. This way, the flexible datacenter 500 can reduce overall computational costs by using the behind-the-meter power to provide computational resources to assist traditional datacenter 902. The remote master control system 300 may use the queue system 312 to temporarily

store and organize the offloaded computational operations until a flexible datacenter (e.g., the flexible datacenter 500) is available to perform them. The flexible datacenter 500 consumes behind-the-meter power without transmission or distribution costs, which lowers the costs associated with performing computational operations originally assigned to the traditional datacenter 902. The remote master control system 300 may further communicate with the flexible datacenter 500 via communication link 922 and the traditional datacenter 902 via the communication link 924.

[0213] Figure 10A shows method 1000 of dynamic power consumption at a flexible datacenter using behind-the-meter power according to one or more example embodiments. Other example methods may be used to manipulate the power delivery to one or more flexible datacenters.

[0214] In step 1010, the datacenter control system, the remote master control system, or another computing system may monitor behind-the-meter power availability. In some embodiments, monitoring may include receiving information or an operational directive from the generation station control system or the grid operator corresponding to behind-the-meter power availability.

[0215] In step 1020, the datacenter control system or the remote master control system 300 may determine when a datacenter ramp-up condition is met. In some embodiments, the datacenter ramp-up condition may be met when there is sufficient behind-the-meter power availability and there is no operational directive from the generation station to go offline or reduce power.

[0216] In step 1030, the datacenter control system may enable behind-the-meter power delivery to one or more computing systems. In some instances, the remote mater control system may directly enable BTM power delivery to computing systems within the flexible system without instructing the datacenter control system.

[0217] In step 1040, once ramped-up, the datacenter control system or the remote master control system may direct one or more computing systems to perform predetermined computational operations. In some embodiments, the predetermined computational operations may include the execution of one or more distributed computing processes, parallel processes, and/or hashing functions, among other types of processes.

[0218] While operational, the datacenter control system, the remote master control system, or another computing system may receive an operational directive to modulate power consumption. In some embodiments, the operational directive may be a directive to reduce power consumption. In such embodiments, the datacenter control system or the remote

master control system may dynamically reduce power delivery to one or more computing systems or dynamically reduce power consumption of one or more computing systems. In other embodiments, the operational directive may be a directive to provide a power factor correction factor. In such embodiments, the datacenter control system or the remote master control system may dynamically adjust power delivery to one or more computing systems to achieve a desired power factor correction factor. In still other embodiments, the operational directive may be a directive to go offline or power down. In such embodiments, the datacenter control system may disable power delivery to one or more computing systems.

[0219] Figure 10B shows method 1050 of dynamic power delivery to a flexible datacenter using behind-the-meter power according to one or more embodiments. In step 1060, the datacenter control system or the remote master control system may monitor behind-the-meter power availability. In certain embodiments, monitoring may include receiving information or an operational directive from the generation station control system or the grid operator corresponding to behind-the-meter power availability.

[0220] In step 1070, the datacenter control system or the remote master control system may determine when a datacenter ramp-down condition is met. In certain embodiments, the datacenter ramp-down condition may be met when there is insufficient behind-the-meter power availability or anticipated to be insufficient behind-the-meter power availability or there is an operational directive from the generation station to go offline or reduce power.

[0221] In step 1080, the datacenter control system may disable behind-the-meter power delivery to one or more computing systems. In step 1090, once ramped-down, the datacenter control system remains powered and in communication with the remote master control system so that it may dynamically power the flexible datacenter when conditions change.

[0222] One of ordinary skill in the art will recognize that a datacenter control system may dynamically modulate power delivery to one or more computing systems of a flexible datacenter based on behind-the-meter power availability or an operational directive. The flexible datacenter may transition between a fully powered down state (while the datacenter control system remains powered), a fully powered up state, and various intermediate states in between. In addition, flexible datacenter may have a blackout state, where all power consumption, including that of the datacenter control system is halted. However, once the flexible datacenter enters the blackout state, it will have to be manually rebooted to restore power to datacenter control system. Generation station conditions or operational directives may cause flexible datacenter to ramp-up, reduce power consumption, change power factor, or ramp-down.

[0223] Figure 11 illustrates a block diagram of a system for implementing control strategies based on a power option agreement, according to one or more embodiments. The system 1100 represents an example arrangement that includes a control system (e.g., the remote master control system 262), a load (e.g., one or more of the datacenters 1102, 1104, and 1106), and a power entity 1140, which may establish and operate in accordance with a power option agreement. Additional arrangements are possible within examples.

[0224] In general, a power option agreement is an agreement between a power entity 1140 associated with the delivery of power to a load (e.g., a grid operator, power generation station, or local control station) and the load (e.g., the datacenters 1102-1106). As part of the power option agreement, the load (e.g., load operator, contracting agent for the load, semi-automated control system associated with the load, and/or automated control system associated with the load) provides the power entity 1140 with the right, but not obligation, to reduce the amount of power delivered (e.g., grid power) to the load up to an agreed amount of power during an agreed upon time interval. In order to provide the power entity 1140 with this option, the load needs to be using at least the amount of power subject to the option (e.g., a minimum power threshold). For instance, the load may agree to use at least 1 MW of grid power at all times during a specified 24-hour time interval to provide the power entity 1140 with the option of being able to reduce the amount of power delivered to the load by any amount up to 1 MW at any point during the specified 24-hour time interval. The load may grant the power entity 1140 with this option in exchange for a monetary consideration (e.g., receive power at a reduced price and/or monetary payment if the option is exercised by the power entity).

[0225] The power option agreement may be used by the power entity 1140 to reserve the right to reduce the amount of grid power delivered to the load during a set time frame (e.g., the next 24 hours). For instance, the power entity 1140 may exercise a predefined power option to reduce the amount of grid power delivered to the load during a time when the grid power may be better redirected to other loads coupled to the power grid. As such, the power entity 1140 may exercise power option agreements to balance loads coupled to the power grid.

[0226] To illustrate an example, a power option agreement may specify that a load (e.g., the datacenters 1102-1106) is required to use at least 10 MW or more at all times during the next 12 hours. Thus, the minimum power threshold according to the power option agreement is 10 MW and this minimum power threshold extends across the time interval of the next 12 hours. In order to comply with the agreement, the load must subsequently operate using 10

MW or more power at all times during the next 12 hours. This way, the load can accommodate a situation where the power entity 1140 exercises the option. Particularly, exercising the option may trigger the load to reduce the amount of power it consumes by an amount up to 10 MW at any point during the 12 hour interval. By establishing this power option agreement, the power entity 1140 can manipulate the amount of power consumed at the load during the next 12 hours by up to 10 MW if power needs to be redirected to another load or a reduction in power consumption is needed for other reasons.

[0227] In the example arrangement of the system 1100 shown in Figure 11, one or more of the datacenters (e.g., the flexible datacenters 1102, 1104, and the traditional datacenter 1106) may operate as the load that is subject to a power option agreement. As the load that is subject to the power option agreement, the datacenters 1102-1106 may execute control instructions in accordance with power target consumption targets that meet or exceed the minimum power thresholds based on the power option agreement.

[0228] As shown in Figure 11, each datacenter 1102-1106 may include a set of computing systems configured to perform computational operations using power from one or more power sources (e.g., BTM power, grid power, and/or grid power subject to a power option agreement). In particular, the flexible datacenter 1102 includes computing systems 1108 arranged into a first set 1114A, a second set 1114B, and a third set 1114C, the flexible datacenter 1104 includes computing systems 1110 arranged into a first set 1116A, a second set 1116B, and a third set 1118B, and the traditional datacenter 1106 includes computing systems 1112 arranged into a first set 1118A, a second set 1118B, and a third set 1118C. Each set of computing systems may include various types of computing systems that can operate in one or more modes.

[0229] The different sets of computing systems as well as the multiple datacenters are included in Figure 11 for illustration purposes. In particular, the variety of computing systems represent different configurations that a load may take while operating in accordance with a power option agreement, and each configuration (as detailed herein) may include ramping up or down power consumption and transferring and performing computational operations between sets of computing systems and/or datacenters. In other examples, the load that is subject to a power option agreement may take on other configurations (e.g., a single datacenter 1102-1106, and/or a single set of computing systems).

[0230] The remote master control system 262 may serve as a control system that can determine performance strategies and provide control instructions to the load (e.g., one or more of the datacenters 1102-1106). In particular, the remote master control system 262 can

monitor conditions in concert with the minimum power thresholds and time intervals (e.g., power option data) set forth in, and/or derived from, one or more power option agreements to determine performance strategies that can enable the load to meet the expectations of the power option agreement(s) while also efficiently using power to accomplish computational operations. In some instances, the remote master control system 262 may also be subject to the power option agreement and may adjust its own power consumption based on the power option agreement (e.g., ramp up or down power consumption based on the defined minimum power thresholds during time intervals).

[0231] To establish a power option agreement, the remote master control system 262 (or another computing system) may communicate with the power entity 1140. For instance, the remote master control system 262 may provide a request (e.g., a signal and/or a bid) to the power entity 1140 and receive the terms of one or more power option agreements, or power option data related to power option agreements (e.g., data such as minimum power thresholds and time intervals, but not all terms contained within a potential power option agreement) in response. In some examples, the remote master control system 262 may evaluate one or more conditions prior to establishing a power option agreement to ensure that the conditions could enable the load (e.g., the datacenters 1102-1106) to operate in accordance with the power option agreement. For instance, the remote master control system 262 may check the quantity and deadlines associated with computational operations assigned to specific datacenters prior to establishing specific datacenters as a load subject to a power option agreement. In some cases, multiple power option agreements may be established. For example, each datacenter 1102-1106 may be subject to a different power option agreement, which may result in the remote master control system 262 managing the power consumption at each of the datacenters 1102-1106 differently.

[0232] Within the system 1100 shown in Figure 11, the power entity 1140 may represent any type of power entity associated with the delivery of power to the load that is subject to a power option agreement. For instance, the power entity 1140 may be a local station control system, a grid operator, or a power generation source. As such, the power entity 1140 may establish power option agreements with the loads via communication with the loads and/or the remote master control system 262. For example, the power entity 1140 may obtain and accept a bid from a load trying to engage in a power option agreement with the power entity 1140. The power entity 1140 is shown with a power option module 1142, which may be used to establish power option agreements (e.g., fixed-duration 1144 and/or dynamic 1146).

[0233] Once a power option agreement is established, the remote master control system 262 may obtain power option data from the power entity 1140 (or another source) that specifies the power and time expectations of the power entity 1140. As shown in Figure 11, the power entity 1140 includes a power option module 1142, which may be used to provide power option data to the remote master control system 262 and/or the datacenters 1102-1106. In particular, the power option data may specify the minimum power threshold or thresholds associated with one or more time intervals for the load to operate at in accordance with based on the power option agreement. The power option data may also specify other constraints that the load should operate in accordance with.

[0234] In some examples, the power option data may also include an indication of a monetary penalty that would be imposed upon the load for failure to operate as agreed upon for the power option agreement. In addition, the power option data may also include an indication of a monetary benefit provided to the load operating at power consumption levels that are in accordance with a power option agreement. For instance, monetary benefits could include reduced prices for power, credits for power, and/or monetary payments.

[0235] In some embodiments, the power entity 1140 may correspond to a qualified scheduling entity (QSE). A QSE may submit bids and offers on behalf of resource entities (REs) or load serving entities (LSEs), such as retail electric providers (REPs). QSEs may submit offers to sell and/or bids to buy power (energy) in the Day-Ahead Market (e.g., the next 24 hours) and the Real-Time Market. As such, the remote master control system 262 or another computing system may communicate with one or more QSEs to engage and control one or more loads in accordance with one or more power option agreements.

[0236] In some examples, a power option agreement may take the form of a fixed duration power option agreement 1144. The fixed duration power option agreement 1144 may specify a set of minimum power thresholds and a set of time intervals in advance for an upcoming fixed duration of time covered by the agreement. Each minimum power threshold in the set of minimum power thresholds may be associated with a time interval in the set of time intervals. Examples of such association are provided in Figure 12. The fixed duration power option agreement may be established in advanced of the time period covered by the set of time intervals to enable the remote master control system 262 to prepare performance strategies for the load (e.g., the datacenter(s)) associated with the power option agreement. Thus, the remote master control system 262 may evaluate the fixed duration power option and other monitored conditions to determine performance strategies for a set of computing

systems (e.g., one or more datacenters) during the different intervals that satisfy the minimum power thresholds.

[0237] In other examples, a power option agreement may take the form of a dynamic power option agreement 1146. For a dynamic power option agreement 1146, minimum power thresholds may be provided to the remote master control system 262 in real-time (or near real-time). For instance, a dynamic power option agreement may specify that the power entity 1140 may provide adjustments to minimum power thresholds and corresponding time intervals in real-time to the remote master control system 262. For example, a dynamic power option agreement may provide power option data that specifies a minimum power threshold for immediate adjustments (e.g., for the next hour).

[0238] In further examples, a power option agreement may operate similarly to both a fixed-duration 1144 and a dynamic power option agreement 1146. Particularly, power option data specifying minimum power thresholds and corresponding time intervals may be provided in advance for the entire fixed-duration of time (e.g., the next 24 hours). Additional power option data may then be subsequently provided enabling the remote master control system 262 to make one or more adjustments to accommodate any changes specified within the additional power option data. For instance, additional power option data may indicate that a power entity exercised its option to deliver less power to the load. As a result, the remote master control system may instruct the load to adjust power consumption based on the power entity reducing the power threshold minimum via exercising the option.

[0239] As indicated above, the remote master control system 262 may monitor conditions in addition to the constraints set forth in power option data received from the power entity 1140. Particularly, the remote master control system 262 may monitor and analyze a set of conditions (including the power option data) to determine strategies for assigning, transferring, and otherwise managing computational operations using the one or more datacenters 1102-1106. The determined strategies may enable efficient operation by the datacenters while also ensuring that the datacenters operate at target power consumption levels that meet or exceed the minimum power thresholds set forth within one or more power option agreements.

[0240] Example monitored conditions include, but are not limited to, power availability 1120, power prices 1122, computing systems parameters 1124, cryptocurrency prices 1126, computational operation parameters 1128, and weather conditions 1129. Power availability 1120 may include determining power consumption ranges at a set of computing systems and/or at one or more datacenters. In addition, power availability 1120 may also involve

determining the source or sources of power available at a datacenter. For instance, the remote master control system 262 may identify the types of power sources (e.g., BTM, grid power, and/or a battery system) that a datacenter has available. Power prices 1122 may involve an analysis of the different costs associated with powering a set of computing systems. For instance, the remote master control system 262 may determine cost of power from the grid without a power option agreement relative to the cost power from the grid under the power option agreement. In addition, the remote master control system 262 may also compare the cost of grid power relative to the cost of BTM power when available at a datacenter. The power prices 1122 may also involve comparing the cost of using power at different datacenters to determine which datacenter may perform computational operations at a lower cost.

[0241] Monitoring computing system parameters 1124 may involve determining parameters related to the computing systems at one or more datacenters. For instance, the remote master control system 262 may monitor various parameters of the computing systems at a datacenter, such as the abilities and availability of various computing systems, the status of the queue used to store computational operations awaiting performance by the computing systems. The remote master control system 262 may determine types and operation modes of the computing systems, including which computing systems could operate in different modes (e.g., a higher power or a lower power mode) and/or at different hash rates and/or frequencies. The remote master control system 262 may also estimate when computing systems may complete current computational operations and/or how many computational operations are assigned to computing systems.

[0242] Monitoring cryptocurrency prices 1126 may involve monitoring the current price of one or more cryptocurrencies, the hash rate and/or estimated power consumption associated with mining each cryptocurrency, and other factors associated with the cryptocurrencies. The remote master control system 262 may use data related to monitoring cryptocurrency prices 1126 to determine whether using computing systems to mine a cryptocurrency generates more revenue than the cost of power required for performance of the mining operations.

[0243] The remote master control system 262 may monitor parameters related to computational operations (e.g., computational operation parameters 1128). For example, the remote master control system 262 may monitor parameters related to the computational operations requiring performance and currently being performed, such quantity of operations, estimated time to complete, cost to perform each computational operation, deadlines and priorities associated with each computational operation. In addition, the remote master

control system 262 may analyze computational operations to determine if a particular type of computing system may perform the computational operation better than other types of computing systems.

[0244] Monitoring weather conditions 1129 may include monitoring for any potential power generation disruption due to emergencies or other events, and changes in temperatures or weather conditions at power generators or datacenters that could affect power generation. As such, the operations and environment analysis module (or another component) of the remote master control system 262 may be configured to monitor one or more conditions described above.

[0245] The performance strategy determined by the remote master control system 262 based on the monitored conditions and/or power option data can include control instructions for the load (e.g., the datacenters and/or one or more sets of computing systems). For instance, a performance strategy can specify operating parameters, such as operating frequencies, power consumption targets, operating modes, power on/off and/or standby states, and other operation aspects for computing systems at a datacenter.

[0246] The performance strategy can also involve aspects related to the assignment, transfer, and performance of computational operations at the computing systems. For instance, the performance strategy may specify computational operations to be performed at the computing systems, an order for completing computational operations based on priorities associated with the computational operations, and an identification of which computing systems should perform which computational operations. In some instances, priorities may depend on revenue associated with completing each computational operation and deadlines for each computational operation.

[0247] The monitored conditions may enable efficient distribution and performance of computational operations among computing systems at one or more datacenters (e.g., datacenters 1102-1106) in ways that can reduce costs and/or time to perform computational operations, take advantage of availability and abilities of computing systems at the datacenters 1102-1106, and/or take advantage in changes in the cost for power at the datacenters 1102-1106. In addition, the monitored conditions may also involve consideration of the power option data to ensure that the computing systems consume enough power to meet minimum power thresholds set forth in one or more power option agreements.

[0248] The various monitored conditions described above as well as other potential conditions may change dynamically and with great frequency. Thus, to enable efficient distribution and performance of the computational operations at the datacenters, the remote

master control system 262 may be configured to monitor changes in the various conditions to assist with the efficient management and operations of the computing systems at each datacenter. For instance, the remote master control system 262 may engage in wired or wireless communication 1130 with datacenter control systems (e.g., datacenter control system 504) at each datacenter as well as other sources (e.g., the power entity 1140) to monitor for changes in the conditions.

[0249] The remote master control system 262 may analyze the different conditions in real-time to modulate operating attributes of computing systems at one or more of the datacenters. By using the monitored conditions, the remote master control system 262 may increase revenue, decrease costs, and/or increase performance of computational operations via various modifications, such as transferring computational operations between datacenters or sets of computing systems within a datacenter and adjusting performance at one or more sets of computing systems (e.g., switching to a low power mode).

[0250] In some examples, the traditional datacenter 1106 may be the load subject to a power option agreement. As such, the remote master control system 262 may factor the power option agreement when determining whether to perform computational operations using the computing systems 1112 at the traditional datacenter 1106 and/or transfer computational operations to the computing systems 1108, 1110 at the flexible datacenters 1102, 1104. For instance, the monitored conditions may indicate that the price of grid power is substantially higher than BTM power. As a result, the remote master control system 262 may transfer a subset of computational operations from the traditional datacenter 1106 to the flexible datacenters 1102, 1104. The traditional datacenter 1106 may still have some computational operations to perform to ensure that the traditional datacenter 1106 is using enough power to meet the minimum power threshold or thresholds set forth in the power option agreement.

[0251] In some examples, the remote master control system 262 may monitor the grid frequency signal received from the power entity 1140. When the frequency of the grid deviates a threshold amount (e.g., 0.036 Hz above or below 60 Hz), the remote master control system 262 may adjust performance strategies at the load. In some cases, the remote master control system 262 may adjust the power consumption at the load, the number of miners (or computing systems) operating at the load, and/or the frequency or hash rate, among other possible changes. The remote master control system may readjust performance strategies at the load in response to receiving additional power option data from the power entity 1140 (e.g., an indication that the frequency of the grid is back to 60Hz). In addition, the remote master control system 262 may communicate changes in operations at the load to the power

entity 1140. This way, the power entity 1140 may obtain confirmation that the load is adjusting in accordance with a power option agreement.

[0252] In some embodiments, a power generation source (e.g., the generation station 400 shown in Figure 4) may enter into a power option agreement with a grid operator, which may provide the grid operator with the option to reduce the amount of power that the power source generator can deliver to the grid during a defined time interval. For instance, a wind generation farm may enter into the power option agreement with the grid operator. In addition, the remote master control system 262 may also enter into a power option agreement with the power generation source (e.g., the wind farm) to provide a load that can receive excess power from the power generation source when the grid operator exercises the option and lowers the amount of power that the power generation source can deliver to the grid. Thus, rather than reducing the amount of power produced, the power generation source could exercise an option in the agreement with remote master control system 262 and redirect excess power to one or more loads (e.g., a set of computing systems) that could ramp up power consumption in response. In such situations, the remote master control system 262 maybe able to use the excess power from the power generation source (e.g., BTM power) to perform operations at one or more loads at a low cost (or no cost at all). In addition, the power generation source may benefit from the power option agreement by directing excess power to the load instead of temporarily halting power production.

[0253] Figure 12 shows a graph representing power option data based on a power option agreement, according to one or more embodiments. The graph 1200 shows power option data arranged according to power 1204 over time 1202. As shown in Figure 12, time 1202 increases along the X-axis and minimum power thresholds 1204 increase along the Y-axis of the graph 1200. In the example embodiment shown in Figure 12, the time 1202 increases up to a full day (e.g., 24 hours) in 4 hour increments and the power is shown in MW increasing in intervals of 5 MW. The 24 duration and example minimum power thresholds can differ in other embodiments. Particularly, these values may depend on the terms set forth within the power option agreement.

[0254] The graph line 1206 represents sets of minimum power thresholds 1206A, 1206B, 1206C that are specified by power option data based on the power option agreement. As shown, the graph line 1206 extends the entire 24 hour duration, which indicates that the set of time intervals associated with minimum power thresholds add up to 24 hours. In other examples, the power option agreement may not include a minimum power threshold during a portion of the duration.

[0255] The graph line 1206 of the graph 1200 is further used to illustrate power consumption levels that one or more loads (e.g., a set of computing systems) operating according to the power option agreement may utilize during the 24 hour duration. Particularly, the power quantities above the graph line 1206 represents power levels that the load(s) may consume from the power grid during the 24 hour duration that would satisfy the requirements (i.e., the minimum power thresholds 1206A-1206C) set forth by the power option agreement. In particular, the power quantities above the graph line 1206 include any power quantity that meets or exceeds the minimum power threshold at that time. By extension, the power quantities positioned below the graph line 1206 represents the amount of power that the load could be directed to reduce power consumption by per the power option agreement.

[0256] To further illustrate, an initial minimum power threshold 1206A is shown associated with the time interval starting at hour 0 and extending to hour 8. In particular, the minimum power threshold 1206A is set at 5 MW during this time interval. Thus, based on the power option data shown in Figure 12, the loads must be able to operate at a target power consumption level that is equal to or greater than the 5 MW minimum power threshold 1206A at all times during the time interval extending from hour 0 to hour 8, in order to be able to satisfy the power option if it is exercised for that time interval. Similarly, the power entity could reduce the power consumed by loads by any amount up to 5 MW at any point during the time interval from hour 0 to hour 8 in accordance with the power option agreement. For instance, the power entity could exercise its option at any point during this time interval to reduce the power consumed by the loads by 3 MW as a way to load balance the power grid. In response to the power entity exercising its option, the load may then operate using 3 MW less power and/or another strategy determined by a control system factoring additional conditions (e.g., the price of grid power, the revenue that could be generated from mining a cryptocurrency, and/or parameters associated with computational operations awaiting performance)

[0257] As further shown in the graph 1200 illustrated in Figure 12, the next minimum power threshold 1206B is associated with the following time interval, which starts at hour 8 and extends until hour 16. During this time interval (hour 8 to hour 16), the load(s) may consume 10 MW or more power since the minimum power threshold 1206B is now set at 10 MW as shown on the Y-axis of the graph 1200. In light of the power option data, a control system may determine and provide a performance strategy to the load (e.g., a set of computing systems) that includes a power consumption target that meets or exceeds the minimum power threshold 1206B (i.e., 10 MW). The performance strategy may depend on the power option

data as well as other possible conditions, such as the price of grid power, the availability of computing systems, and/or the type of computing operations, etc. In addition, the power entity could exercise its option to reduce the amount of power consumed by the load by 10 MW or less as represented by the power levels under the minimum threshold 1206B that extend during the time interval of hour 8 to hour 16.

[0258] The last minimum power threshold 1206C is associated with the time interval that starts at hour 16 and extends until hour 24. Similar to the initial minimum power threshold 1206A associated with the beginning of the graph line 1206, the last minimum power threshold 1206 is also set at 5 MW. As such, at any point during this interval (hour 16 to hour 24) the loads may consume 5 MW or more to operate in accordance with the power option agreement. As discussed above, by operating at 5MW or more, the load enables the power consumed from the power grid to be reduced any amount from zero up to 5 MW during this time interval.

[0259] When determining the power consumption strategy for a load, a computing system (e.g., the remote master control system 262) may consider various conditions in addition to the power option data received based on one or more power option agreements. Particularly, the computing system may consider and weigh different conditions in addition to the power option data to determine power consumption targets and/or other control instructions for a load. The conditions may include, but are not limited to, the price of grid power, the price of alternative power sources (e.g., BTM power, stored energy), the revenue associated with mining for one or more cryptocurrencies, parameters related to the computational operations requiring performance (e.g., priorities, deadlines, status of the queue organizing the operations, and/or revenue associated with completing each computational operation), parameters related to the set of computing systems (e.g., types and availabilities of computing systems), and other conditions (e.g., penalties if a minimum power threshold is not met and/or monetary benefits from operating under a power option agreement). By weighing various conditions, the computing system may efficiently manage the set of computing systems, including enabling performance of computational operations cost effectively and/or ensuring at that computing systems operate at target power consumption levels that one or more satisfy power option agreements.

[0260] In some examples, the computing system may decrease the amount of power that a set of computing systems consumes from one source and while also increasing the amount of power that the set consumes from another source. For instance, the computing system may determine that the price of power grid power is above a threshold price that makes

computational operations relatively expensive to perform using grid power. As a result, the computing system may provide control instructions for the computing systems to consume power grid power that matches a minimum power threshold specified by power option data. This may enable the computing systems to satisfy the power option agreement while also avoiding using pricey grid power beyond the minimum amount required per the power option data. In addition, the computing system may instruct some computing systems to switch to a low power mode or temporarily stop until the price of power from the grid decreases. The computing system may instruct one or more computing systems to operate using power from another source (e.g., BTM power and/or stored energy from a battery system) and/or transfer one or more computational operations to another set of computing systems (e.g., a different datacenter).

[0261] When the power option agreement is a fixed duration power option agreement, the computing system may receive an indication of all the minimum power thresholds 1206A-1206C and an indication of the associated time interval altogether and in advance of the duration associated with the power option agreement. By providing all of the minimum power thresholds 1206A-1206C and the time intervals in advance, the computing system may determine a performance strategy for the load that can extend across the entire duration. Particularly, the computing system may factor the minimum power thresholds and associated time intervals as well as other monitored conditions to determine the performance strategy for the total duration. This can enable the computing system to accept and assign computational operations to computing systems in advance while also using a performance strategy that meets the expectations of a power option agreement.

[0262] In some examples, the performance strategy determined by the computing system may include control instructions for the set of computing systems to execute if a power option is exercised. For instance, the performance strategy may specify different power consumption targets for the computing systems that depend on whether a power option is exercised during each time interval.

[0263] In some instances, the computing system may modify the performance strategy when one or more conditions change enough to warrant a modification. For instance, the computing system may receive an indication of a change in a minimum power threshold (e.g., a decrease in the minimum power threshold) and determine one or more modifications based on the new minimum power threshold and/or other conditions (e.g., a change in the price of power).

[0264] In other examples, the power option agreement may be a dynamic power option agreement. Particularly, the load may be subject to a changing minimum power threshold that can vary during a predefined duration associated with the power option agreement. For example, a dynamic power option agreement may specify that the load is subject to a minimum power threshold that may vary from 0 MW up to 5 MW during the next 24 hours and the particular minimum threshold for each hour may depend on power option data received from the power entity during the prior hour. The dynamic power option agreement may further specify the expected response time from the load. For instance, the power option agreement may indicate that an indication of a new minimum power threshold will be provided an hour prior to the start of the minimum power threshold. The computing system, for example, may receive an indication at hour 7 about the increase in the minimum power threshold 1206B starting at hour 8. The indication may (or may not) specify the total time interval associated with a new minimum power threshold. For instance, the indication received by the computing system may specify that the 10 MW minimum power threshold 1206B extends from hour 8 until hour 16. In other instances, the power option data may indicate that the computing system should abide by the new minimum power threshold until receiving further power option data indicating a change to another new minimum power threshold.

[0265] In some examples, the power option data may arrive at the computing system in an unknown order from the power entity with expectations of swift power consumption adjustments by the load. As a result, the power option agreement may require fast ramping of the load to meet changes. Ramping may involve ramping up or down power consumption as well as ramping operating techniques (e.g., adjusting frequency or operation mode).

[0266] In some embodiments, the type of power option power agreement may depend on the delivery and content of power option data provided to the load (or a control system controlling the load). For instance, a computing system may receive minimum power thresholds set across an entire duration associated with a power option agreement in advance when the power option agreement is a fixed-duration power option agreement. In other instances, the computing system may receive power option data dynamically and adjust operations in real-time (or near real-time). For instance, the computing system may receive a series of power option data that each specifies minimum power threshold changes during the duration set forth in the dynamic power option agreement. To illustrate an example, the computing system may receive power option data during hour 1 that specifies the minimum power threshold for hour 2, power option data during hour 2 that specifies the minimum

power threshold for hour 3, and so on across the duration of the dynamic power option agreement.

[0267] In some examples, the minimum power threshold for a time interval may be zero during the duration of a power option agreement. As such, the load may use any amount of power from the power grid in accordance with the power option agreement, including no power at all during this time interval. When the price for power is high during this time frame, the load may ramp down power usage to zero MW to avoid paying the high price for power while still being in compliance with the power option agreement.

[0268] Figure 13 illustrates a method for implementing control strategies based on a fixed-duration power option agreement, according to one or more embodiments. The method 1300 serves as an example and may include other steps within other embodiments. A control system (e.g., the remote master control system 262) may be configured to perform one or more steps of the method 1300. As such, the control system may take various forms of a computing system, such as a mobile computing device, a wearable computing device, a network of computing systems, etc.

[0269] At step 1302, the method 1300 involves monitoring a set of conditions. For instance, a computing system (e.g., a control system) may monitor various conditions that could impact the performance of operations at one or more loads, including the power consumption targets at the loads. The set of monitored conditions may include a variety of information obtained from one or more external sources, such as one or more datacenters, databases, power generation stations, or types of sources.

[0270] Some example conditions include, but are not limited to, the price of grid power, the price and availability of alternative power options (e.g. BTM power, and/or stored energy), parameters of the load (e.g., ramping abilities, type of computing systems, operation modes, etc.), parameters of tasks to be performed using the power at the load (e.g., types, deadlines, priorities, and/or revenue associated with computational operations), availability of other computing systems and their associated costs, and/or revenue associated with mining a cryptocurrency. The computing system may monitor one or more of these conditions as well as others.

[0271] At step 1304, the method 1300 involves receiving power option data based, at least in part, on a power option agreement. As discussed above, the computing system (e.g., a remote master control system) may engage in a power option agreement with a power entity. As a result, the computing system may control a load (e.g., a set of computing systems) in

accordance with power thresholds and time intervals received from the power entity based on the power option agreement.

[0272] In some examples, the power option data may specify a set of minimum power thresholds and a set of time intervals. Each minimum power threshold in the set of minimum power thresholds may be associated with a time interval in the set of time intervals. To illustrate an example, the power option data may specify a first minimum power threshold associated with a first time interval and a second minimum power threshold associated with a second time interval, with the second time interval subsequent to the first time interval.

[0273] The set of time intervals may add up to the duration represented by the power option agreement. For instance, the total duration of the set of time intervals may correspond to a twenty-four hour period (e.g., the next day). In other examples, the power option agreement may span across a different duration (e.g., 12 hours).

[0274] At step 1306, the method 1300 involves determining a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions. The performance strategy may be determined responsive to receiving the power option data. In addition, the performance strategy may include a power consumption target for the set of computing systems for each time interval in the set of time intervals. In some examples, each power consumption target is equal to or greater than the minimum power threshold associated with each time interval.

[0275] As an example, the performance strategy may specify a first power consumption target for the set of computing systems for a first time interval such that the first power consumption target is equal to or greater than a first minimum power threshold associated with the first time interval and a second power consumption target for the set for a second time interval in a similar manner (i.e., the second power consumption target is equal to or greater than a second minimum power threshold).

[0276] In some examples, the performance strategy may include an sequence for the set of computing systems to follow when performing computational operations. The sequence, for example, may be based on priorities associated with the computational operations. In addition, the performance strategy may include one or more power consumption targets that are greater than the minimum power thresholds when the price of power from the power grid is below a threshold price during the time intervals associated with the minimum power thresholds.

[0277] The performance strategy may also involve transferring, delaying, or adjusting one or more computational operations performed at the set of computing systems. In addition, the

performance strategy may involve adjusting operations at the computing systems. For instance, one or more computing systems may switch modes (e.g., operate at a higher frequency or switch to a low power mode).

[0278] In addition, the performance strategy may also specify power consumption targets for the set of computing systems to use if the power option is exercised during an interval. This way, the computing systems may continue to perform computational operations (or suspend performance) based on the power option being exercised.

[0279] At step 1308, the method 1300 involves providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy. For example, the set of computing systems may operate according to the performance strategy to ensure that the minimum power thresholds are met during the defined time intervals based on the power option agreement.

[0280] Some examples may further involve receiving subsequent power option data based, at least in part, on the power option agreement. The subsequent power option data may specify to decrease one or more minimum power thresholds of the set of power thresholds. Responsive to receiving the subsequent power option data, the performance strategy for the set of computing systems may be modified based on a combination of at least a portion of the subsequent power option data and one or more conditions of the monitored conditions. The modified performance strategy may include one or more reduced power consumption targets for the set of computing systems. The amount of the reduction in a power consumption target may depend linearly with the amount that the corresponding minimum power threshold was reduced by. For instance, when a minimum power threshold for a time interval is reduced from 10 MW to 5 MW, the power consumption target for that time interval may be reduced from 10 MW to 5 MW. Instructions may be provided to the set of computing systems to perform computational operations based on the modified performance strategy.

[0281] Figure 14 illustrates a method for implementing control strategies based on a dynamic power option agreement, according to one or more embodiments. The method 1400 serves as an example and may include other steps within other embodiments. Similar to the method 1400, a control system (e.g., the remote master control system 262) may be configured to perform one or more steps of the method 1400. As such, the control system may take various forms of a computing system, such as a mobile computing device, a wearable computing device, a network of computing systems, etc.

[0282] At block 1402, the method 1400 involves monitoring a set of conditions. Similar to block 1302 of the method 1300, a computing system may monitor various conditions to determine instructions for controlling a set of computing systems.

[0283] At block 1404, the method 1400 involves receiving first power option data based, at least in part, on a power option agreement while monitoring the set of conditions. The first power option data may specify a first minimum power threshold associated with a first time interval. For example, the first power option data may specify a minimum power threshold of 10 MW for the next hour, which may start in an hour or less.

[0284] The power option agreement may correspond to a dynamic power option agreement in some examples. When managing a load with respect to a dynamic power option agreement, a computing system may receive power option data specifying changes in minimum power thresholds that a load (e.g., the set of computing systems) may be designated to use in the near term (e.g., the next hour). For example, the computing system may receive power option data during each hour of the duration specified by a power option agreement that indicates a minimum power threshold for the next hour.

[0285] At block 1406, the method 1400 involves providing first control instructions for a set of computing systems based on a combination of at least a portion of the first power option data and at least one condition. The first control instructions may be provided responsive to receiving the first power option data.

[0286] The first control instructions may include a first power consumption target for the set of computing systems for the first time interval. Particularly, the first power consumption target may be equal to or greater than the first minimum power threshold associated with the first time interval. For example, the first power consumption target may be greater than the first minimum power threshold when a cost of power from the power grid is below a threshold price during the first time interval. In other instances, the first power consumption target may be equal to the first minimum power threshold when the cost of power from the power grid is greater than the threshold price.

[0287] In some examples, control instructions may specify a sequence for the computing systems to follow when performing computational operations. The sequence may be based on priorities associated with each computational operation.

[0288] The first control instructions may be determined based on a combination of the first power option data, the price of power from the power grid, and parameters associated with computational operations to be performed at the set of computing systems.

[0289] In some examples, the first control instructions may involve ramping up or down power consumption at the set of computing systems. The power consumption may be ramped up or down based on the first minimum power threshold and one or more other conditions (e.g., the price of power).

[0290] At block 1408, the method 1400 involves receiving second power option data based, at least in part, on the power option agreement while monitoring the set of conditions. The computing system may receive the second power option data subsequent to receiving the first power option data. The second power option data may specify a second minimum power threshold associated with a second time interval. For example, the second minimum power threshold may be 7 MW over the duration of the upcoming hour. In other examples, the second minimum power threshold may differ as shown in Figures 12.

[0291] In some instances, the computing system may receive the second power option data during the first time interval such that the second time interval overlaps the first time interval. For instance, the computing system may receive the second power option data to enable real-time adjustments to be made to the power consumed at the set of computing systems.

[0292] At block 1410, the method 1400 involves providing second control instructions for the set of computing systems based on a combination of at least a portion of the second power option data and at least one condition. The second control instructions may be provided responsive to receiving the second power option data. The second control instructions may specify a second power consumption target for the set of computing systems for the second time interval. The second power consumption target may equal to or greater than the second minimum power threshold associated with the second time interval.

[0293] In some examples, the computing system may provide a request to a QSE to determine the power option agreement. As such, the computing system may receive power option data (e.g., the first and second power option data) in response to providing the request to the QSE.

[0294] The computing system may monitor the price of power from the power grid, and the global mining hash rate and a price for a cryptocurrency (e.g., Bitcoin), among other conditions. The computing system may determine control instructions (e.g., the first and/or second control instructions) based on a combination of power option data, the price of power from the power grid, and the global mining hash rate and the price for the cryptocurrency. For instance, the computing system may cause one or more computing systems (e.g., a subset of computing systems) to perform mining operations for the cryptocurrency when the price of

power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

[0295] Advantages of one or more embodiments of the present invention may include one or more of the following:

[0296] One or more embodiments of the present invention provides a green solution to two prominent problems: the exponential increase in power required for growing blockchain operations and the unutilized and typically wasted energy generated from renewable energy sources.

[0297] One or more embodiments of the present invention allows for the rapid deployment of mobile datacenters to local stations. The mobile datacenters may be deployed on site, near the source of power generation, and receive low cost or unutilized power behind-the-meter when it is available.

[0298] One or more embodiments of the present invention provide the use of a queue system to organize computational operations and enable efficient distribution of the computational operations across multiple datacenters.

[0299] One or more embodiments of the present invention enable datacenters to access and obtain computational operations organized by a queue system.

[0300] One or more embodiments of the present invention allows for the power delivery to the datacenter to be modulated based on conditions or an operational directive received from the local station or the grid operator.

[0301] One or more embodiments of the present invention may dynamically adjust power consumption by ramping-up, ramping-down, or adjusting the power consumption of one or more computing systems within the flexible datacenter.

[0302] One or more embodiments of the present invention may be powered by behind-the-meter power that is free from transmission and distribution costs. As such, the flexible datacenter may perform computational operations, such as distributed computing processes, with little to no energy cost.

[0303] One or more embodiments of the present invention provides a number of benefits to the hosting local station. The local station may use the flexible datacenter to adjust a load, provide a power factor correction, to offload power, or operate in a manner that invokes a production tax credit and/or generates incremental revenue.

[0304] One or more embodiments of the present invention allows for continued shunting of behind-the-meter power into a storage solution when a flexible datacenter cannot fully utilize excess generated behind-the-meter power.

[0305] One or more embodiments of the present invention allows for continued use of stored behind-the-meter power when a flexible datacenter can be operational but there is not an excess of generated behind-the-meter power.

[0306] One or more embodiments of the present invention allows for management and distribution of computational operations at computing systems across a fleet of datacenters such that the performance of the computational operations take advantages of increased efficiency and decreased costs.

[0307] It will also be recognized by the skilled worker that, in addition to improved efficiencies in controlling power delivery from intermittent generation sources, such as wind farms and solar panel arrays, to regulated power grids, the invention provides more economically efficient control and stability of such power grids in the implementation of the technical features as set forth herein.

[0308] While the present invention has been described with respect to the above-noted embodiments, those skilled in the art, having the benefit of this disclosure, will recognize that other embodiments may be devised that are within the scope of the invention as disclosed herein. Accordingly, the scope of the invention should be limited only by the appended claims.

CLAIMS

What is claimed is:

1. A system comprising:

a set of computing systems, wherein the set of computing systems is configured to perform computational operations using power from a power grid; and

a control system configured to:

monitor a set of conditions;

while monitoring the set of conditions, receive first power option data based, at least in part, on a power option agreement, wherein the first power option data specify a first minimum power threshold associated with a first time interval;

responsive to receiving the first power option data, provide first control instructions for the set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions, wherein the first control instructions comprises a first power consumption target for the set of computing systems for the first time interval, and wherein the first power consumption target is equal to or greater than the first minimum power threshold associated with the first time interval;

while monitoring the set of conditions, receive second power option data based, at least in part, on the power option agreement, wherein the second power option data specify a second minimum power threshold associated with a second time interval; and

responsive to receiving the second power option data, provide second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions,

wherein the second control instructions comprises a second power consumption target for the set of computing systems for the second time interval, and wherein the second power consumption target is equal to or greater than the second minimum power threshold associated with the second time interval.

2. The system of claim 1, wherein the control system is configured to:

receive the second power option data subsequent to receiving the first power option data.

3. The system of claim 2, wherein the first time interval corresponds to a first hour and the second time interval corresponds to a second hour, and

wherein the second hour is subsequent to the first hour.

4. The system of claim 1, wherein the control system is configured to monitor the set of conditions comprising:

a price of power from the power grid; and

a plurality of parameters associated with one or more computational operations to be performed at the set of computing systems.

5. The system of claim 4, wherein the control system is configured to:

determine the first control instructions for the set of computing systems based on a combination of at least the portion of the first power option data, the price of power from the power grid, and the plurality of parameters associated with the one or more computational operations.

6. The system of claim 5, wherein the first control instructions specify an order for the set of computing systems to follow when performing the one or more computational operations, wherein the order is based on respective priorities associated with the one or more computational operations.

7. The system of claim 1, wherein the first power consumption target is greater than the first minimum power threshold when a cost of power from the power grid is below a threshold price during the first time interval.

8. The system of claim 1, wherein the first power consumption target is equal to the first minimum power threshold when a cost of power from the power grid is above a threshold price during the first time interval.

9. The system of claim 1, wherein the control system is a remote master control system positioned remotely from the set of computing systems.

10. The system of claim 1, wherein the control system is a mobile computing device.

11. The system of claim 1, wherein the control system is further configured to:

provide a request to a qualified scheduling entity (QSE) to determine the power option agreement; and

receive first power option data in response to providing the request to the QSE.

12. The system of claim 1, wherein the set of conditions monitored by the control system further comprise:

a price of power from the power grid; and

a global mining hash rate and a price for a cryptocurrency; and

wherein the control system is configured to:

determine the second control instructions for the set of computing systems based on a combination of at the portion of the second power option data, the price of power from the power grid, and the global mining hash rate and the price for the cryptocurrency,

wherein the second control instructions specify for at least a subset of the set of computing systems to perform mining operations for the cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

13. The system of claim 1, wherein the control system is further configured to:

receive the second power option data during the first time interval such that the second time interval overlaps the first time interval.

14. A method comprising:

monitoring, at a computing system, a set of conditions;

while monitoring the set of conditions, receiving first power option data based, at least in part, on a power option agreement, wherein the first power option data specify a first minimum power threshold associated with a first time interval;

responsive to receiving the first power option data, providing first control instructions for a set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions, wherein the first control

instructions comprises a first power consumption target for the set of computing systems for the first time interval, and wherein the first power consumption target is equal to or greater than the first minimum power threshold associated with the first time interval;

while monitoring the set of conditions, receiving second power option data based, at least in part, on the power option agreement, wherein the second power option data specify a second minimum power threshold associated with a second time interval; and

responsive to receiving the second power option data, providing second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions, wherein the second control instructions comprises a second power consumption target for the set of computing systems for the second time interval, and wherein the second power consumption target is equal to or greater than the second minimum power threshold associated with the second time interval.

15. The method of claim 14, wherein monitoring the set of conditions comprises:

monitoring: (i) a price of power from a power grid, (ii) a plurality of parameters associated with a set of computational operations to be performed at the set of computing systems, and (iii) a plurality of parameters associated with the set of computing systems.

16. The method of claim 15, wherein providing first control instructions for the set of computing systems based on the combination of at least the portion of the first power option data and at least one condition of the set of conditions comprises:

providing first control instructions based on a weighted combination of the first power option data, the price of power from the power grid, the plurality of parameters associated

with the set of computational operations, and the plurality of parameters associated with the set of computing systems.

17. The method of claim 16, wherein providing the first control instructions based on the weighted combination comprises:

providing the first control instructions such that the set of computing systems ramp up power consumption when the price of power from the power grid is below a threshold price.

18. The method of claim 17, further comprising:

detecting an increase in the price of power from the power grid such that the price of power from the power grid is above a threshold price; and

wherein providing second control instructions for the set of computing systems based on the combination of at least the portion of the second power data and at least one condition of the set of conditions comprises:

providing the second control instructions such that the second power consumption target is equal to the second minimum power threshold during the second time interval.

19. The method of claim 14, wherein receiving second power option data based, at least in part, on the power option agreement comprises:

receiving the second power option data during the first time interval; and

wherein providing second control instructions for the set of computing systems comprises:

providing the second control instructions for the set of computing systems prior to an end of the first time interval.

20. A non-transitory computer readable medium having stored therein instructions executable by one or more processors to cause a computing system to perform functions comprising:

monitoring a set of conditions;

while monitoring the set of conditions, receiving first power option data based, at least in part, on a power option agreement, wherein the first power option data specify a first minimum power threshold associated with a first time interval;

responsive to receiving the first power option data, providing first control instructions for a set of computing systems based on a combination of at least a portion of the first power option data and at least one condition of the set of conditions, wherein the first control instructions comprises a first power consumption target for the set of computing systems for the first time interval, and wherein the first power consumption target is equal to or greater than the first minimum power threshold associated with the first time interval;

while monitoring the set of conditions, receiving second power option data based, at least in part, on the power option agreement, wherein the second power option data specify a second minimum power threshold associated with a second time interval; and

responsive to receiving the second power option data, providing second control instructions for the set of computing systems based on a combination of at least a portion of the second power data and at least one condition of the set of conditions, wherein the second control instructions comprises a second power consumption target for the set of computing systems for the second time interval, and wherein the second power consumption target is equal to or greater than the second minimum power threshold associated with the second time interval.

21. A system comprising:

a set of computing systems, wherein the set of computing systems is configured to perform computational operations using power from a power grid;

a control system configured to:

monitor a set of conditions;

receive power option data based, at least in part, on a power option agreement, wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals, wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;

responsive to receiving the power option data, determine a performance strategy for the set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions, wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals, wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and

provide instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.

22. The system of claim 21, wherein the control system is configured to monitor the set of conditions comprising:

a price of power from the power grid; and

a plurality of parameters associated with one or more computational operations to be performed at the set of computing systems.

23. The system of claim 22, wherein the control system is configured to:

determine the performance strategy for the set of computing systems based on a combination of at least the portion option data, the price of power from the power grid, and the plurality of parameters associated with the one or more computational operations.

24. The system of claim 23, wherein the performance strategy further comprises:

an order for the set of computing systems to follow when performing the one or more computational operations, wherein the order is based on respective priorities associated with the one or more computational operations.

25. The system of claim 24, wherein the performance strategy further comprises:

at least one power consumption target that is greater than a minimum power threshold when the price of power from the power grid is below a threshold price during the time interval associated with the minimum power threshold.

26. The system of claim 21, wherein the control system is further configured to:

receive subsequent power option data based, at least in part, on the power option agreement,

wherein the subsequent power option data specify to decrease one or more minimum power thresholds of the set of minimum power thresholds.

27. The system of claim 26, wherein the control system is further configured to:

responsive to receiving the subsequent power option data, modify the performance strategy for the set of computing systems based on a combination of at least the portion of the subsequent power option data and at least one condition in the set of conditions,

wherein the modified performance strategy comprises one or more reduced power consumption targets for the set of computing systems.

28. The system of claim 27, wherein the control system is further configured to:

provide instructions to the set of computing systems to perform the one or more computational operations based on the modified performance strategy.

29. The system of claim 21, wherein the control system is a remote master control system positioned remotely from the set of computing systems.

30. The system of claim 21, wherein the control system is a mobile computing device.

31. The system of claim 21, wherein the control system is configured to receive the power option data while monitoring the set of conditions.

32. The system of claim 21, wherein the control system is further configured to:

provide a request to a qualified scheduling entity (QSE) to determine the power option agreement; and

receive power option data in response to providing the request to the QSE.

33. The system of claim 21, wherein the power option data specify: (i) a first minimum power threshold associated with a first time interval in the set of time intervals, and (ii) a second minimum power threshold associated with a second time interval in the set of time intervals,

wherein the second time interval is subsequent to the first time interval.

34. The system of claim 33, wherein the control system is configured to:

determine the performance strategy for the set of computing systems such that the performance strategy comprises:

a first power consumption target for the set of computing systems for the first time interval, wherein the first power consumption target is equal to or greater than the first minimum power threshold; and

a second power consumption target for the set of computing systems for the second time interval, wherein the second power consumption target is equal to or greater than the second minimum power threshold.

35. The system of claim 21, wherein a total duration of the set of time intervals corresponds to a twenty-four hour period.

36. The system of claim 21, wherein the set of conditions monitored by the control system further comprise:

a price of power from the power grid; and

a global mining hash rate and a price for a cryptocurrency; and

wherein the control system is configured to:

determine the performance strategy for the set of computing systems based on a combination of at the portion of the power option data, the price of power from the power grid, the global mining hash rate and the price for the cryptocurrency,

wherein the performance strategy specifies for at least a subset of the set of computing systems to perform mining operations for the cryptocurrency when the price of power from the power grid is equal to or less than a revenue obtained by performing the mining operations for the cryptocurrency.

37. A method comprising:

monitoring, by a computing system, a set of conditions;

receiving, at the computing system, power option data based, at least in part, on a power option agreement, wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set of time intervals, wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;

responsive to receiving the power option data, determining a performance strategy for a set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions, wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals, wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and

providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy.

38. The method of claim 37, wherein determining the performance strategy for the set of computing systems comprises:

identifying information about the set of computing systems; and

determining the performance strategy to further comprise instructions for at least a subset of the set of computing systems to operate at an increased frequency based on a combination of at least the portion of the power option data and the information about the set of computing systems.

39. The method of claim 37, further comprising:

receiving subsequent power option data based, at least in part, on the power option agreement, wherein the subsequent power option data specify to decrease one or more minimum power thresholds of the set of minimum power thresholds;

responsive to receiving the subsequent power option data, modifying the performance strategy for the set of computing systems based on a combination of at least the portion of the subsequent power option data and at least one condition in the set of conditions, wherein the modified performance strategy comprises one or more reduced power consumption targets for the set of computing systems; and

providing instructions to the set of computing systems to perform the one or more computational operations based on the modified performance strategy.

40. A non-transitory computer readable medium having stored therein instructions executable by one or more processors to cause a computing system to perform functions comprising:

monitoring a set of conditions;

receiving power option data based, at least in part, on a power option agreement, wherein the power option data specify: (i) a set of minimum power thresholds, and (ii) a set

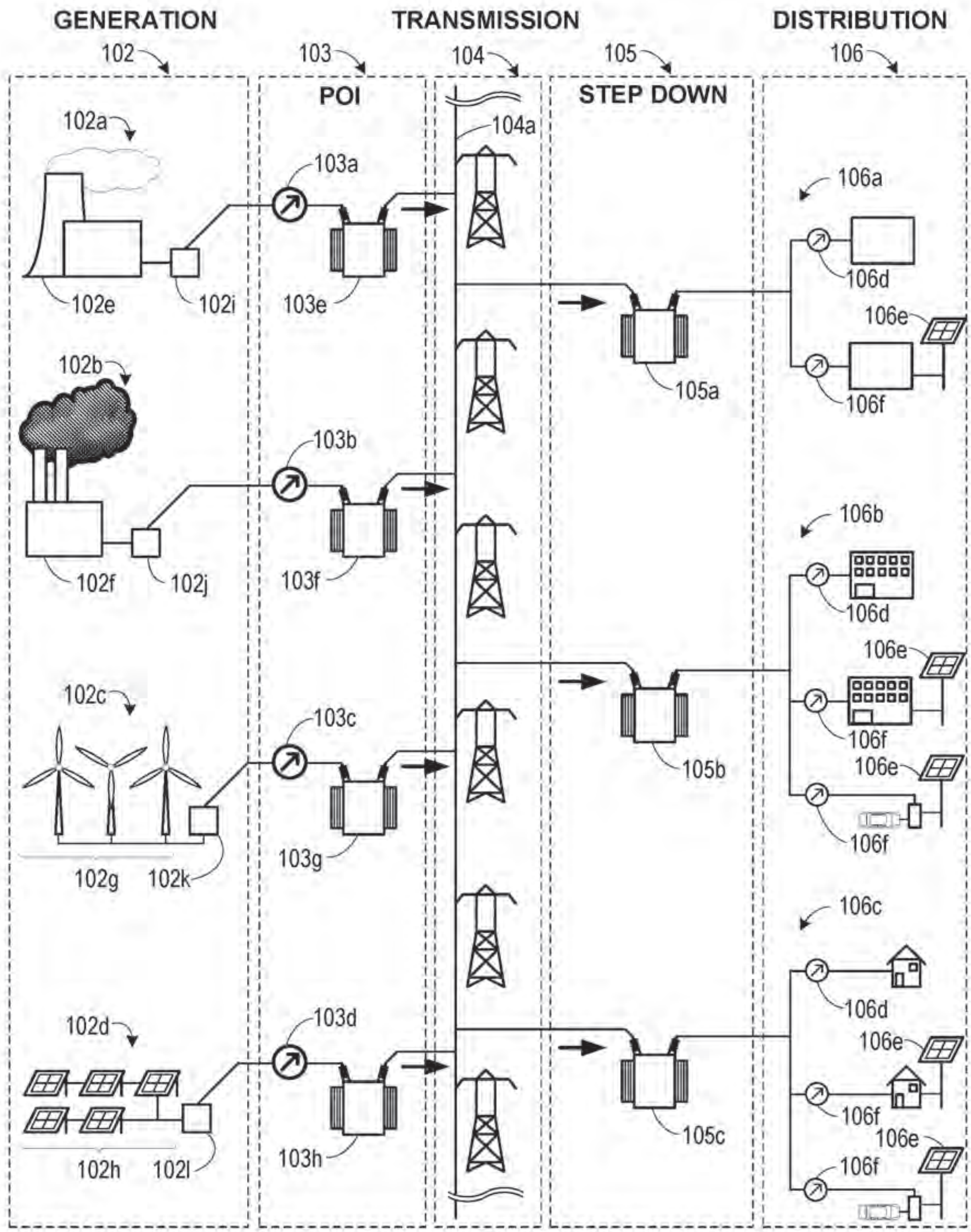
of time intervals, wherein each minimum power threshold in the set of minimum power thresholds is associated with a time interval in the set of time intervals;

responsive to receiving the power option data, determining a performance strategy for a set of computing systems based on a combination of at least a portion of the power option data and at least one condition in the set of conditions, wherein the performance strategy comprises a power consumption target for the set of computing systems for each time interval in the set of time intervals, wherein each power consumption target is equal to or greater than the minimum power threshold associated with each time interval; and

providing instructions to the set of computing systems to perform one or more computational operations based on the performance strategy

ABSTRACT

Examples relate to adjusting load power consumption based on a power option agreement. A computing system may receive power option data that is based on a power option agreement and specify minimum power thresholds associated with time intervals. The computing system may determine a performance strategy for a load (e.g., set of computing systems) based on a combination of the power option data and one or more monitored conditions. The performance strategy may specify a power consumption target for the load for each time interval such that each power consumption target is equal to or greater than the minimum power threshold associated with each time interval. The computing system may provide instructions the set of computing systems to perform one or more computational operations based on the performance strategy.



PRIOR ART
FIGURE 1

LANCIUM00013310

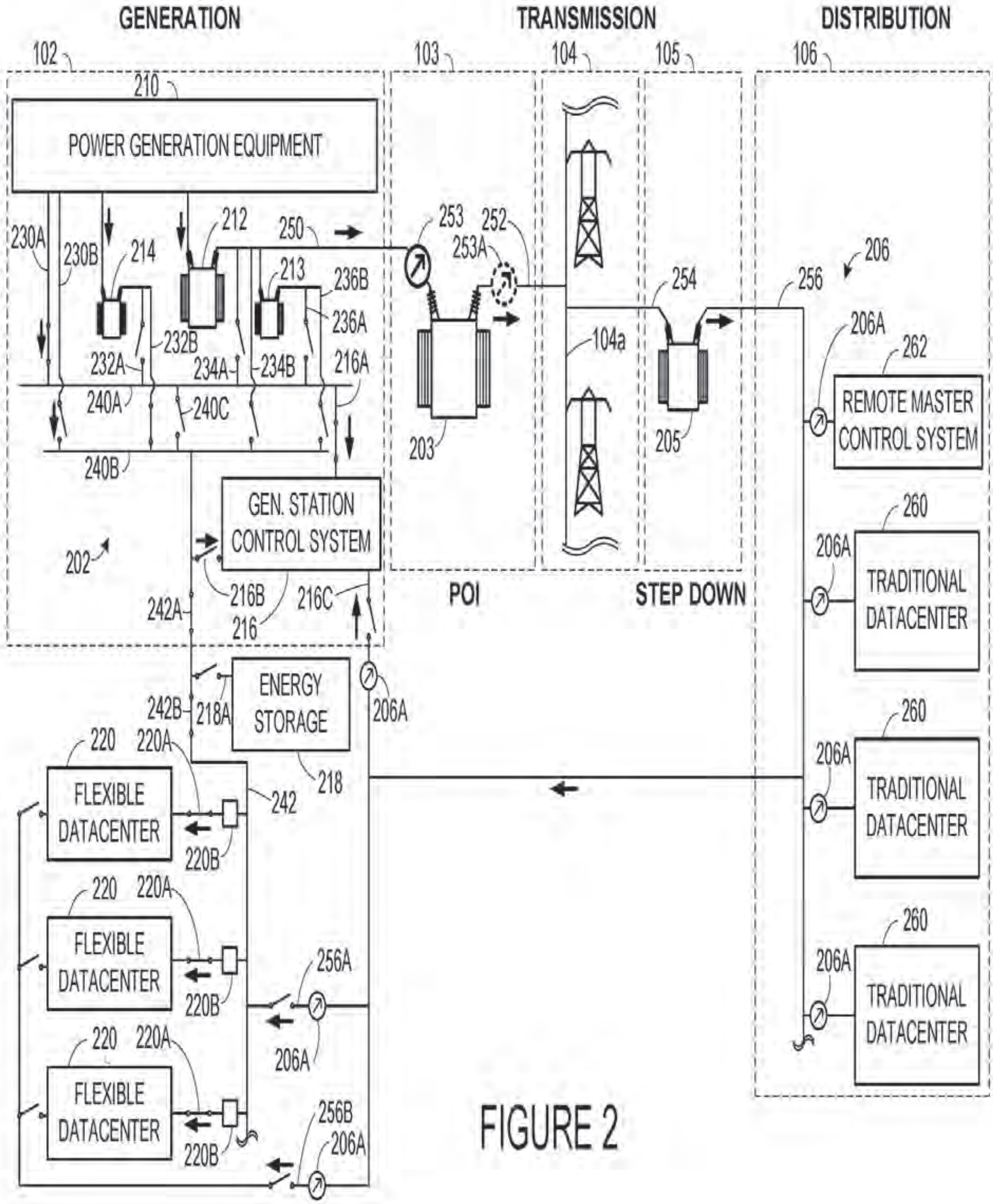


FIGURE 2

LANCIUM00013311

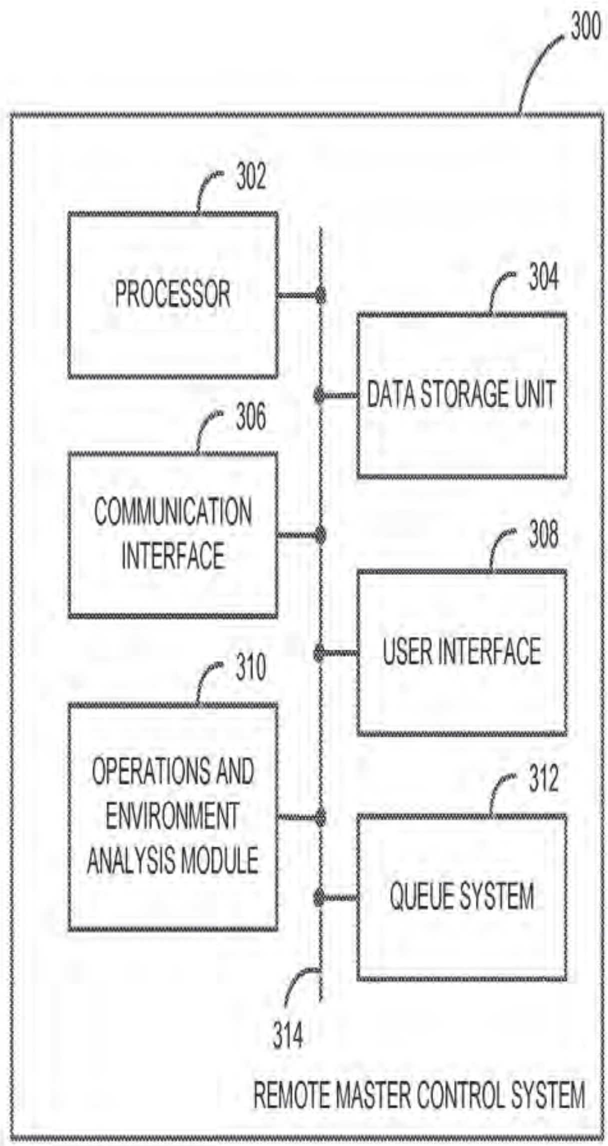

300
302
PROCESSOR
304
DATA STORAGE UNIT
306
COMMUNICATION INTERFACE
308
USER INTERFACE
310
OPERATIONS AND ENVIRONMENT ANALYSIS MODULE
312
QUEUE SYSTEM
314
REMOTE MASTER CONTROL SYSTEM

FIGURE 3

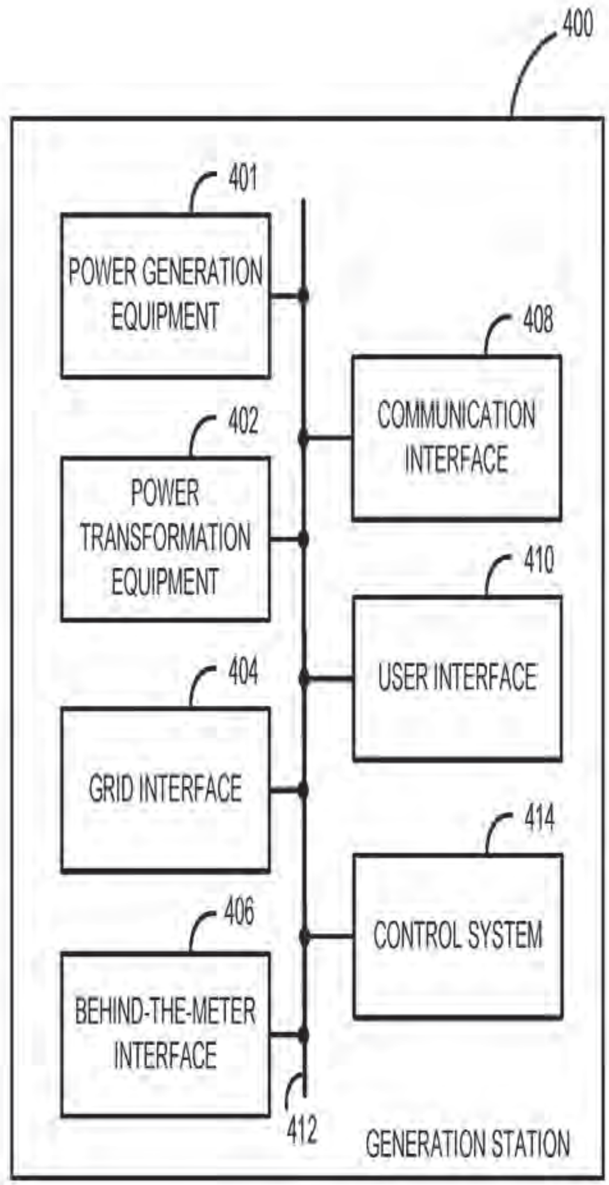

400
401
POWER GENERATION EQUIPMENT
402
POWER TRANSFORMATION EQUIPMENT
404
GRID INTERFACE
406
BEHIND-THE-METER INTERFACE
408
COMMUNICATION INTERFACE
410
USER INTERFACE
414
CONTROL SYSTEM
412
GENERATION STATION

FIGURE 4

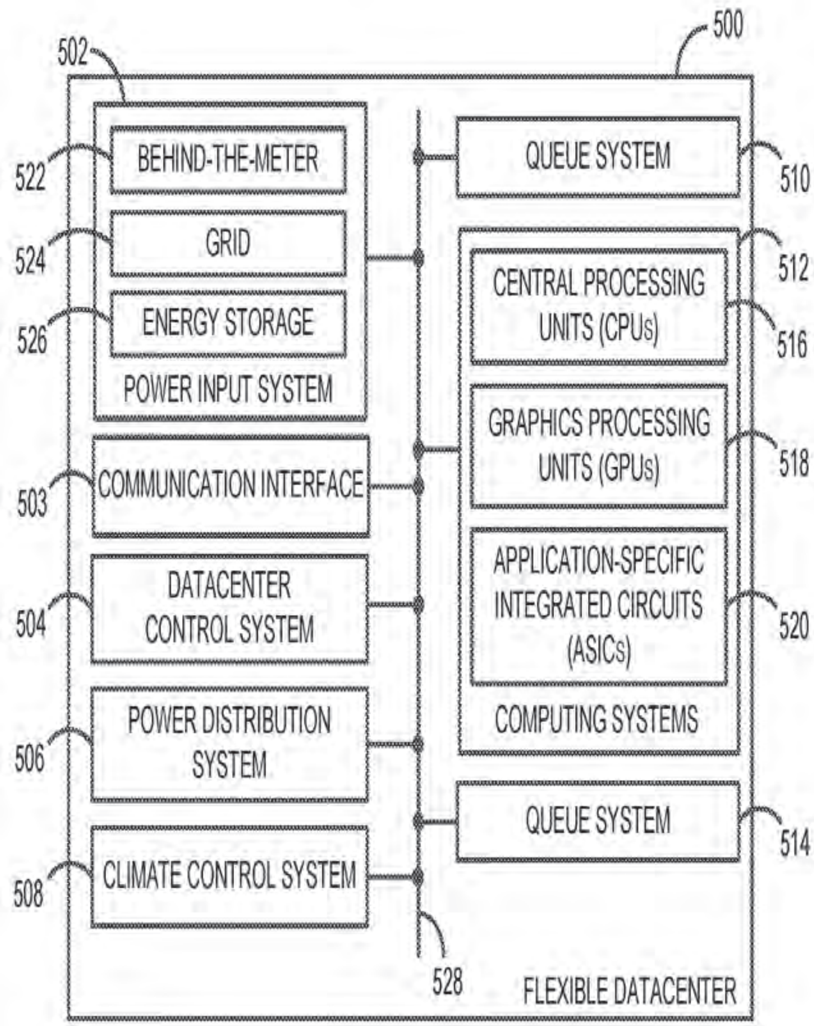

500
502
BEHIND-THE-METER
522
GRID
524
ENERGY STORAGE
526
POWER INPUT SYSTEM
COMMUNICATION INTERFACE
503
DATACENTER CONTROL SYSTEM
504
POWER DISTRIBUTION SYSTEM
506
CLIMATE CONTROL SYSTEM
508
QUEUE SYSTEM
510
512
CENTRAL PROCESSING UNITS (CPUs)
516
GRAPHICS PROCESSING UNITS (GPUs)
518
APPLICATION-SPECIFIC INTEGRATED CIRCUITS (ASICs)
520
COMPUTING SYSTEMS
QUEUE SYSTEM
514
528
FLEXIBLE DATACENTER

FIGURE 5

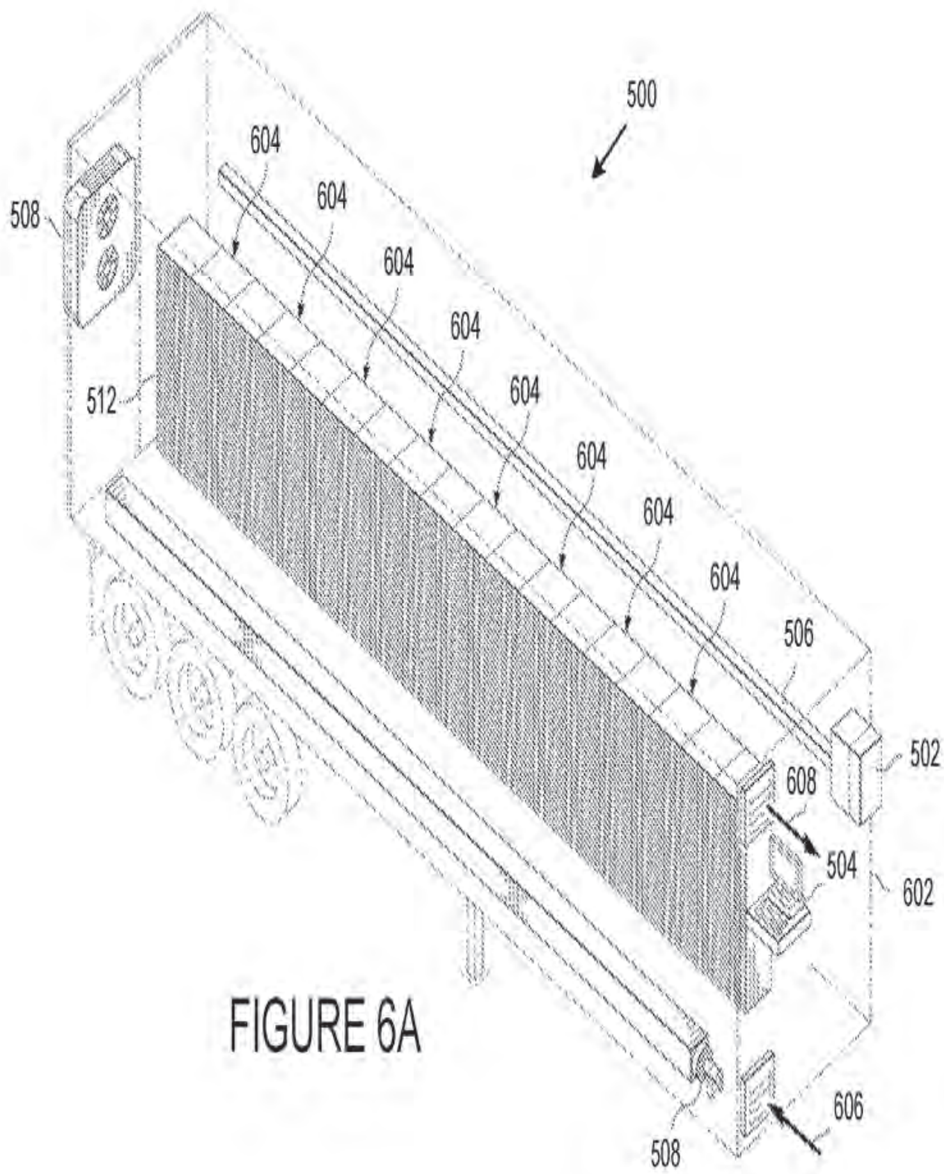

500
604
604
604
604
604
604
604
604
508
512
506
502
608
504
602
606
508

FIGURE 6A

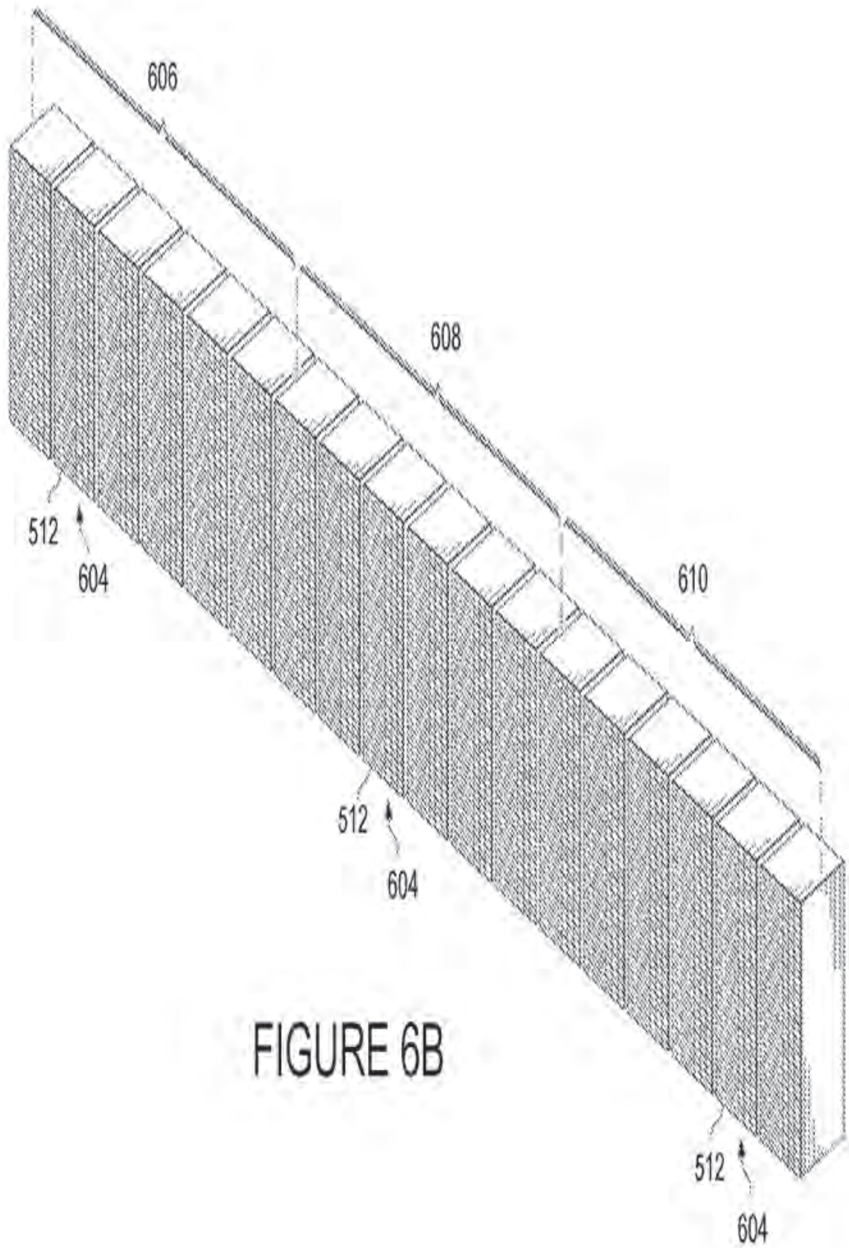


FIGURE 6B

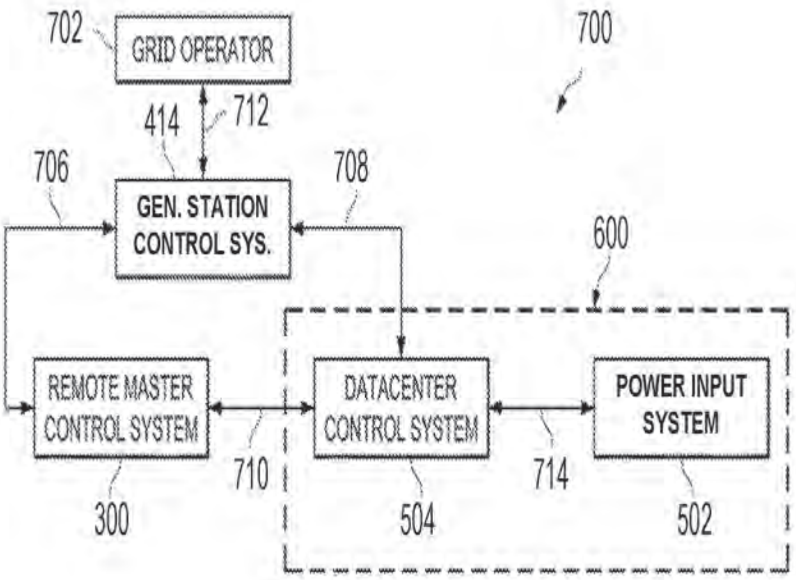


FIGURE 7

LANCIUM00013317

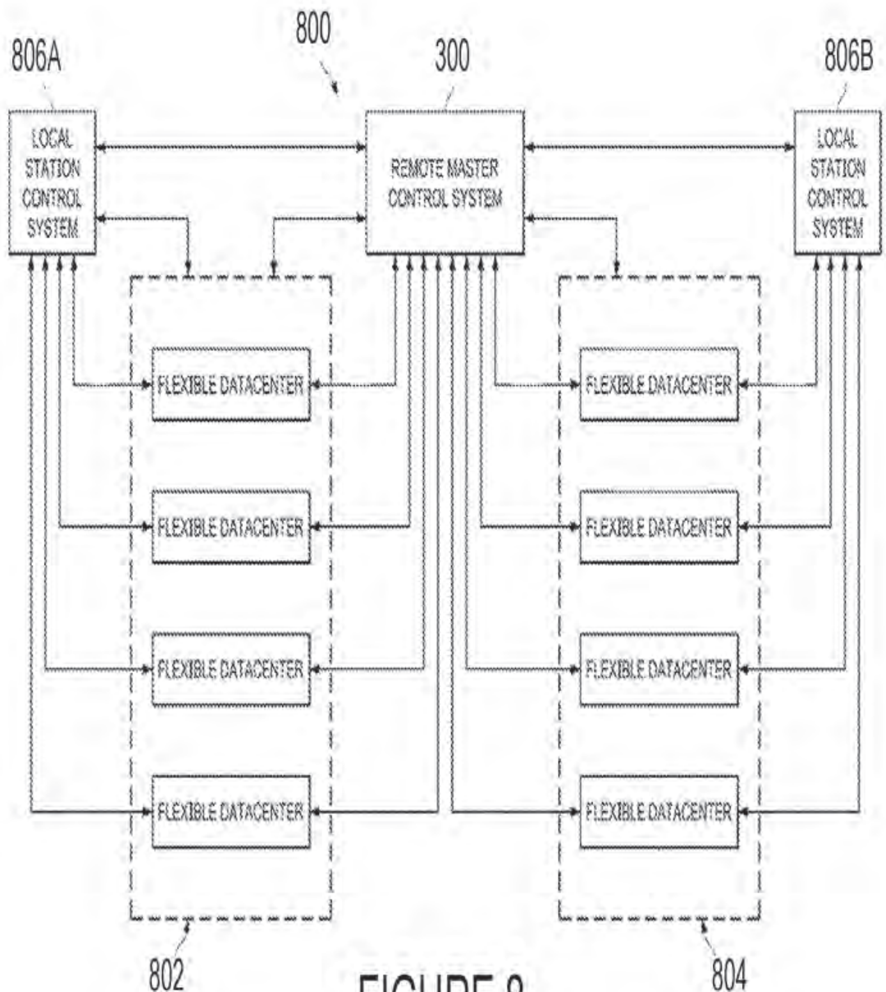

800
806A
300
806B
LOCAL STATION CONTROL SYSTEM
REMOTE MASTER CONTROL SYSTEM
LOCAL STATION CONTROL SYSTEM
FLEXIBLE DATACENTER
FLEXIBLE DATACENTER
FLEXIBLE DATACENTER
FLEXIBLE DATACENTER
FLEXIBLE DATACENTER
FLEXIBLE DATACENTER
FLEXIBLE DATACENTER
FLEXIBLE DATACENTER
802
804

FIGURE 8

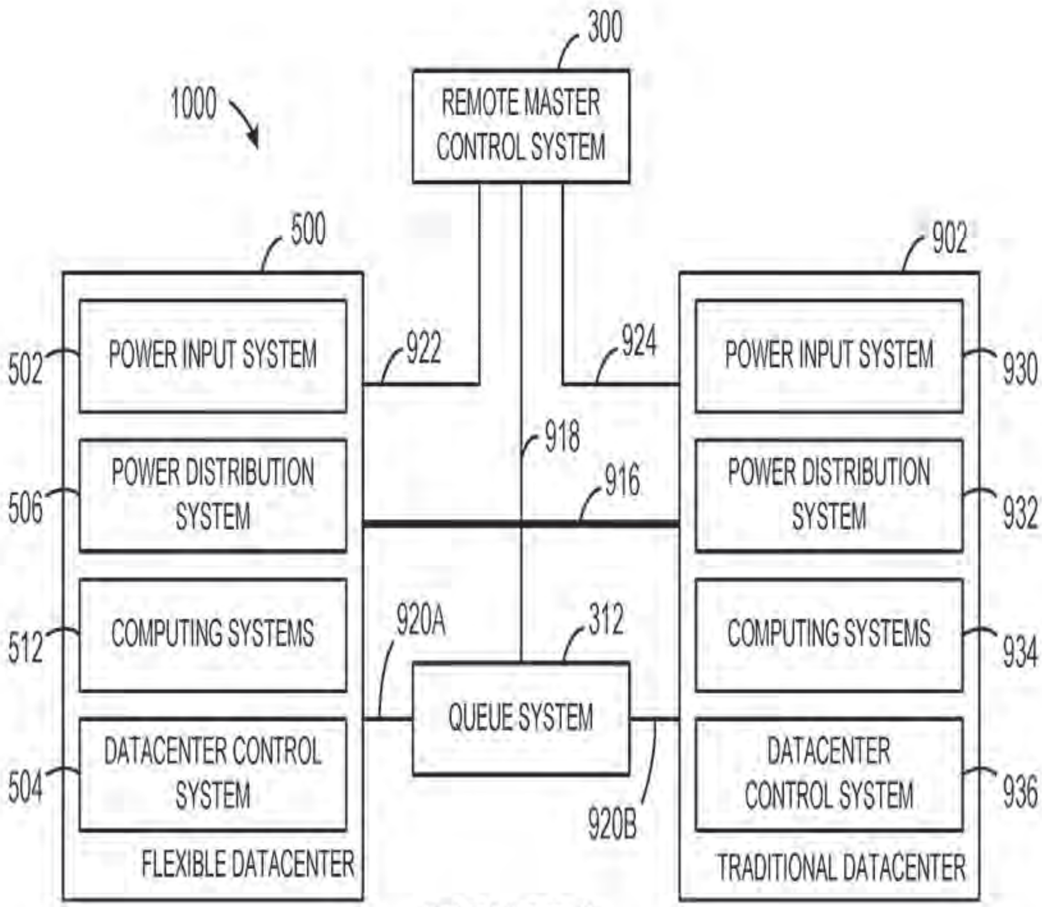

1000
300
REMOTE MASTER CONTROL SYSTEM
500
902
502
POWER INPUT SYSTEM
922
924
POWER INPUT SYSTEM
930
918
506
POWER DISTRIBUTION SYSTEM
916
POWER DISTRIBUTION SYSTEM
932
512
COMPUTING SYSTEMS
920A
312
COMPUTING SYSTEMS
934
QUEUE SYSTEM
504
DATACENTER CONTROL SYSTEM
DATACENTER CONTROL SYSTEM
936
920B
FLEXIBLE DATACENTER
TRADITIONAL DATACENTER

FIGURE 9

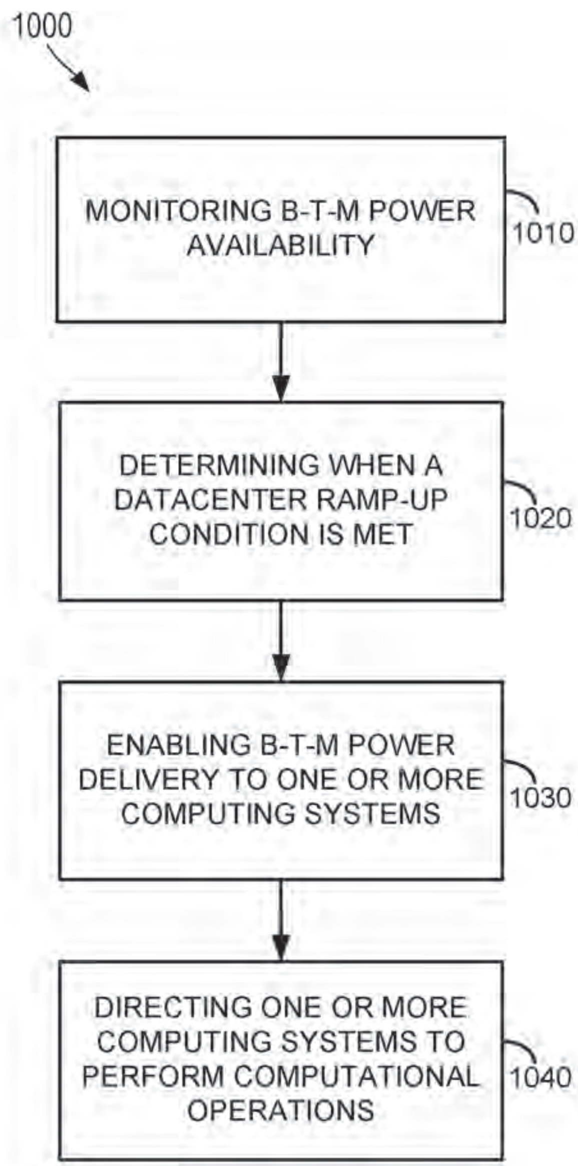

1000
MONITORING B-T-M POWER AVAILABILITY
1010
DETERMINING WHEN A DATACENTER RAMP-UP CONDITION IS MET
1020
ENABLING B-T-M POWER DELIVERY TO ONE OR MORE COMPUTING SYSTEMS
1030
DIRECTING ONE OR MORE COMPUTING SYSTEMS TO PERFORM COMPUTATIONAL OPERATIONS
1040

FIGURE 10A

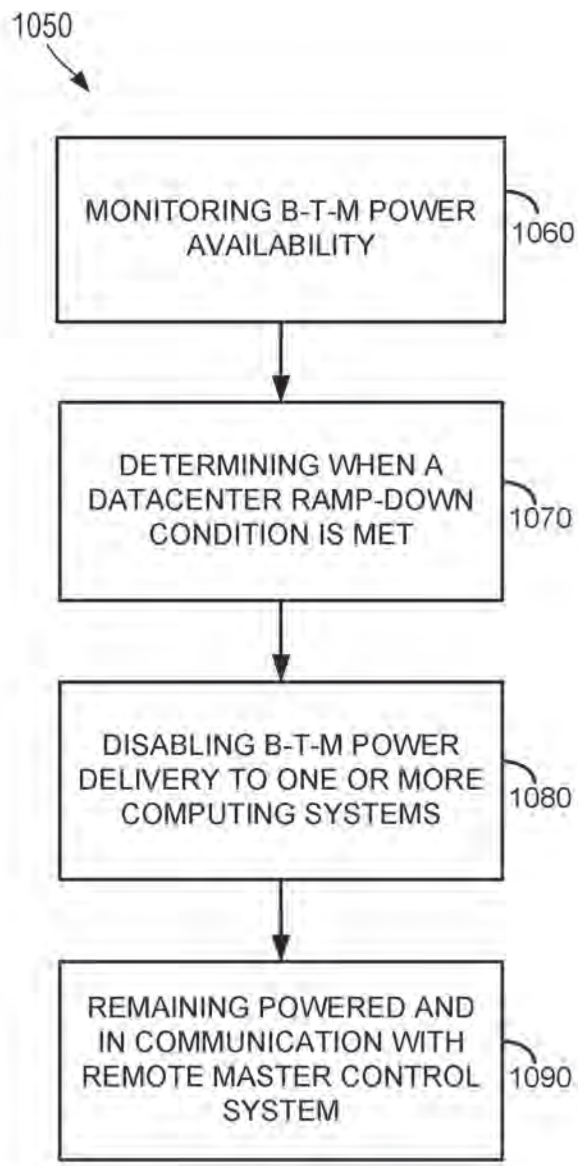

1050
MONITORING B-T-M POWER AVAILABILITY
1060
DETERMINING WHEN A DATACENTER RAMP-DOWN CONDITION IS MET
1070
DISABLING B-T-M POWER DELIVERY TO ONE OR MORE COMPUTING SYSTEMS
1080
REMAINING POWERED AND IN COMMUNICATION WITH REMOTE MASTER CONTROL SYSTEM
1090

FIGURE 10B

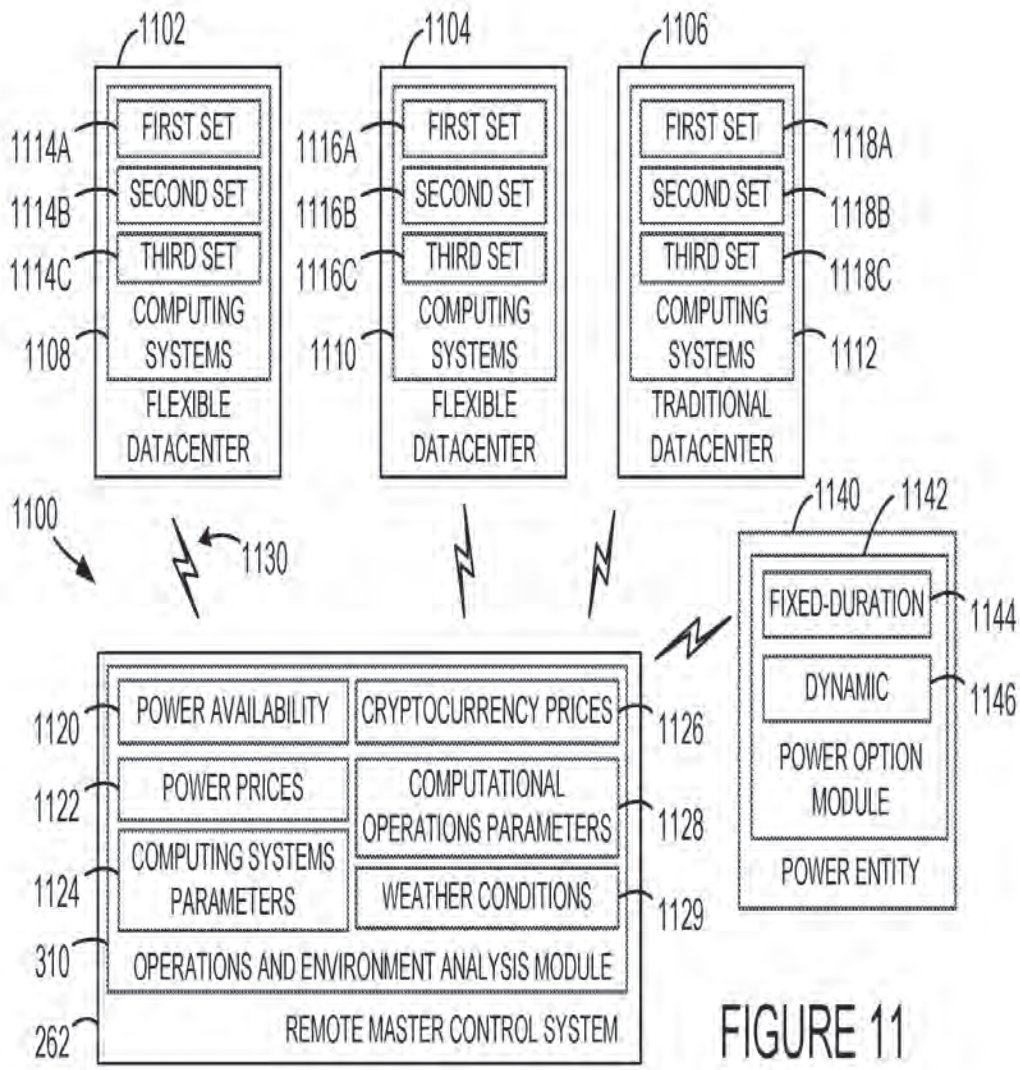

1102
1104
1106
1114A
FIRST SET
1114B
SECOND SET
1114C
THIRD SET
1108
COMPUTING SYSTEMS
FLEXIBLE DATACENTER
1116A
FIRST SET
1116B
SECOND SET
1116C
THIRD SET
1110
COMPUTING SYSTEMS
FLEXIBLE DATACENTER
FIRST SET
1118A
SECOND SET
1118B
THIRD SET
1118C
COMPUTING SYSTEMS
1112
TRADITIONAL DATACENTER
1100
1130
1140
1142
FIXED-DURATION
1144
DYNAMIC
1146
POWER OPTION MODULE
POWER ENTITY
1120
POWER AVAILABILITY
CRYPTOCURRENCY PRICES
1126
1122
POWER PRICES
COMPUTATIONAL OPERATIONS PARAMETERS
1128
1124
COMPUTING SYSTEMS PARAMETERS
WEATHER CONDITIONS
1129
310
OPERATIONS AND ENVIRONMENT ANALYSIS MODULE
262
REMOTE MASTER CONTROL SYSTEM

FIGURE 11

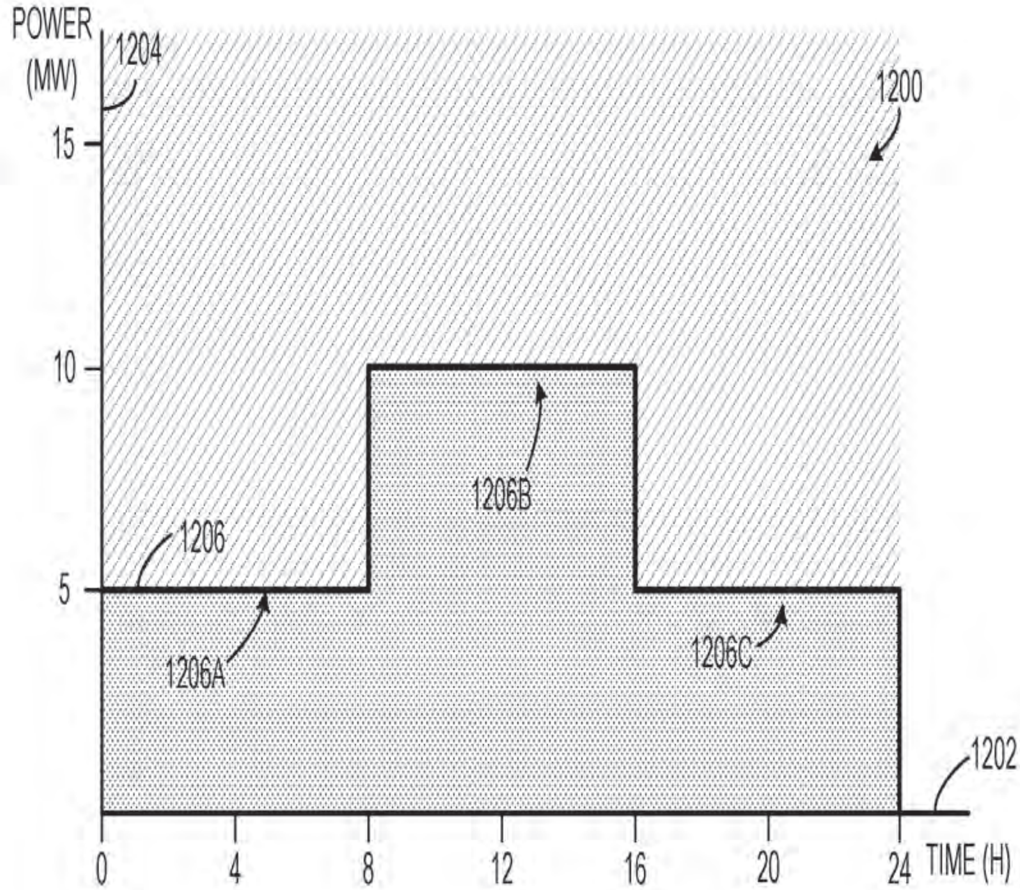

POWER
(MW)
1204
1200
15
10
1206B
1206
5
1206A
1206C
1202
0
4
8
12
16
20
24
TIME (H)

FIGURE 12

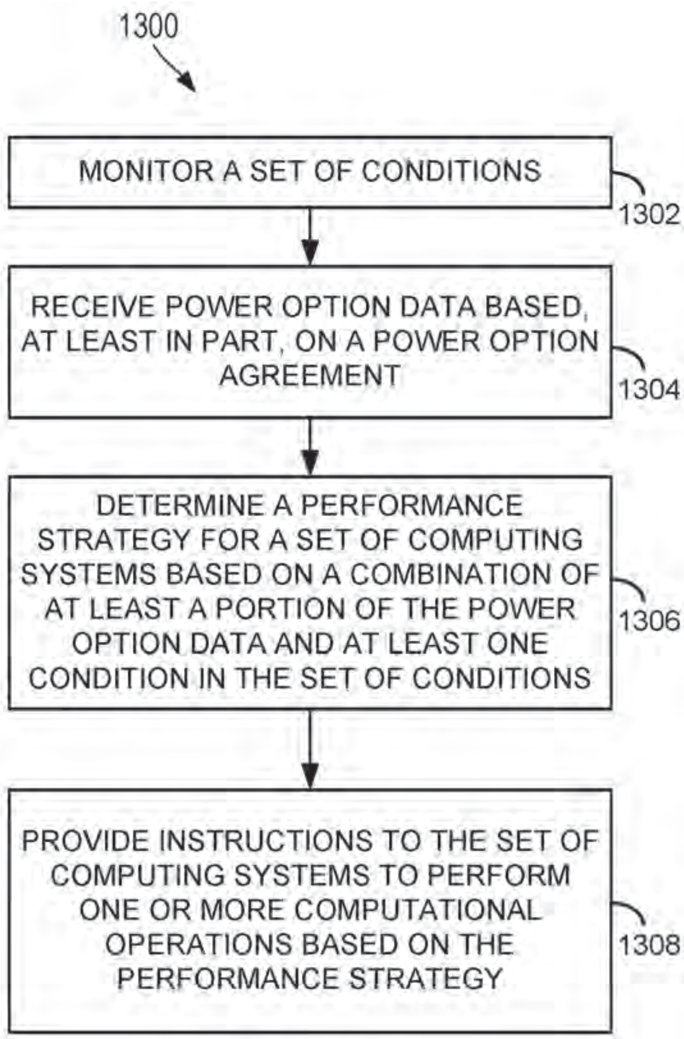

1300
MONITOR A SET OF CONDITIONS
1302
RECEIVE POWER OPTION DATA BASED, AT LEAST IN PART, ON A POWER OPTION AGREEMENT
1304
DETERMINE A PERFORMANCE STRATEGY FOR A SET OF COMPUTING SYSTEMS BASED ON A COMBINATION OF AT LEAST A PORTION OF THE POWER OPTION DATA AND AT LEAST ONE CONDITION IN THE SET OF CONDITIONS
1306
PROVIDE INSTRUCTIONS TO THE SET OF COMPUTING SYSTEMS TO PERFORM ONE OR MORE COMPUTATIONAL OPERATIONS BASED ON THE PERFORMANCE STRATEGY
1308

FIGURE 13

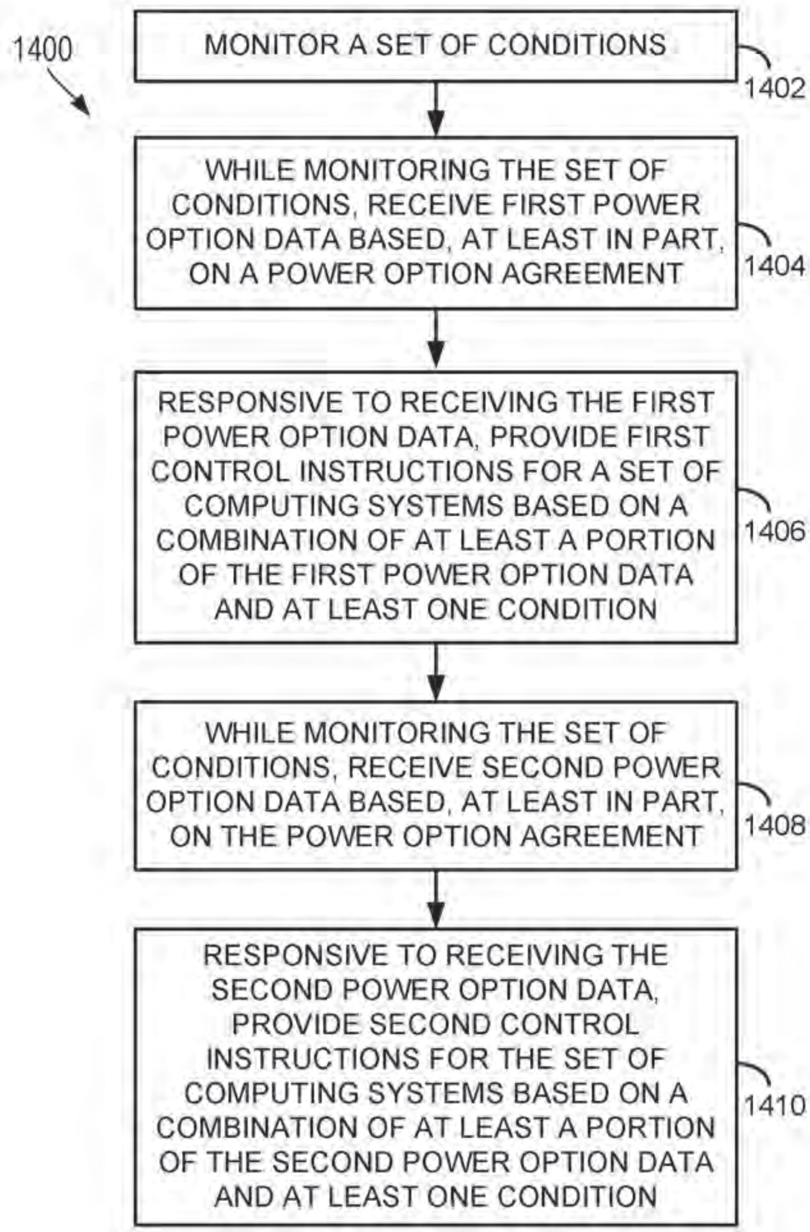

1400
MONITOR A SET OF CONDITIONS
1402
WHILE MONITORING THE SET OF CONDITIONS, RECEIVE FIRST POWER OPTION DATA BASED, AT LEAST IN PART, ON A POWER OPTION AGREEMENT
1404
RESPONSIVE TO RECEIVING THE FIRST POWER OPTION DATA, PROVIDE FIRST CONTROL INSTRUCTIONS FOR A SET OF COMPUTING SYSTEMS BASED ON A COMBINATION OF AT LEAST A PORTION OF THE FIRST POWER OPTION DATA AND AT LEAST ONE CONDITION
1406
WHILE MONITORING THE SET OF CONDITIONS, RECEIVE SECOND POWER OPTION DATA BASED, AT LEAST IN PART, ON THE POWER OPTION AGREEMENT
1408
RESPONSIVE TO RECEIVING THE SECOND POWER OPTION DATA, PROVIDE SECOND CONTROL INSTRUCTIONS FOR THE SET OF COMPUTING SYSTEMS BASED ON A COMBINATION OF AT LEAST A PORTION OF THE SECOND POWER OPTION DATA AND AT LEAST ONE CONDITION
1410

FIGURE 14

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	19-2070-PRO
	Application Number	

Title of Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Michael	T.	McNamara	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City	Newport Beach	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	6006 Thomas Road		
Address 2			
City	Houston	State/Province	TX
Postal Code	77041	Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Raymond	E.	Cline	Jr.

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

City	Houston	State/Province	TX	Country of Residence	US

Mailing Address of Inventor:

Address 1	6006 Thomas Road		
Address 2			
City	Houston	State/Province	TX
Postal Code	77041	Country	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	19-2070-PRO
	Application Number	
Title of Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement	

☐ An Address is being provided for the correspondence Information of this application.			
Customer Number	20306		
Email Address	docketing@mbhb.com	Add Email	Remove Email

Application Information:

Title of the Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement		
Attorney Docket Number	19-2070-PRO	Small Entity Status Claimed	☒
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	16	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., “Domestic Benefit/National Stage Information” and “Foreign Priority Information”).

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number			

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	19-2070-PRO
	Application Number	
Title of Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

			Remove
Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	19-2070-PRO
	Application Number	
Title of Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	19-2070-PRO
	Application Number	
Title of Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	Lancium LLC		
Mailing Address Information For Applicant:			
Address 1	6006 Thomas Road		
Address 2			
City	Houston	**State/Province**	TX
Country	US	Postal Code	77041
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	19-2070-PRO
	Application Number	

Title of Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Alexander D. Georges/			Date (YYYY-MM-DD)	2019-10-28
First Name	Alexander D.	Last Name	Georges	Registration Number	70534

Additional Signature may be generated within this form by selecting the Add button. Add

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	19-2070-PRO
	Application Number	

Title of Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 05/31/2015. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Provisional Application for Patent Cover Sheet

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Inventor(s)

Inventor 1 Remove

Given Name	Middle Name	Family Name	City	State	Country i
Michael	T.	McNamara	Newport Beach	CA	US

Inventor 2 Remove

Given Name	Middle Name	Family Name	City	State	Country i
Raymond	E.	Cline Jr.	Houston	TX	US

All Inventors Must Be Listed – Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Title of Invention	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement
Attorney Docket Number (if applicable)	19-2070-PRO

Correspondence Address

Direct all correspondence to (select one):

◉ The address corresponding to Customer Number	○ Firm or Individual Name
Customer Number	20306

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

- No.
- Yes, the invention was made by an agency of the United States Government. The U.S. Government agency name is:
- Yes, the invention was under a contract with an agency of the United States Government. The name of the U.S. Government agency and Government contract number are:

Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

PTO/SB/16 (11-08)
Approved for use through 05/31/2015. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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Entity Status
Applicant asserts small entity status under 37 CFR 1.27 or applicant certifies micro entity status under 37 CFR 1.29

- (●) Applicant asserts small entity status under 37 CFR 1.27
- ( ) Applicant certifies micro entity status under 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
- ( ) No

Warning

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

Signature

Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Alexander D. Georges/			Date (YYYY-MM-DD)	2019-10-28
First Name	Alexander D.	Last Name	Georges	Registration Number (If appropriate)	70534

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **This form can only be used when in conjunction with EFS-Web. If this form is mailed to the USPTO, it may cause delays in handling the provisional application.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or paten. Accordingly, pursuant to the requirements of the Act, please be advised that : (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement
First Named Inventor/Applicant Name:	Michael T. McNamara
Filer:	Alexander D. Georges
Attorney Docket Number:	19-2070-PRO

Filed as Small Entity

Filing Fees for **Provisional**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
PROVISIONAL APPLICATION FILING FEE	2005	1	140	140
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**140**

Electronic Acknowledgement Receipt

EFS ID:	37585511
Application Number:	62927119
International Application Number:	
Confirmation Number:	5934
Title of Invention:	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement
First Named Inventor/Applicant Name:	Michael T. McNamara
Customer Number:	20306
Filer:	Alexander D. Georges
Filer Authorized By:	
Attorney Docket Number:	19-2070-PRO
Receipt Date:	28-OCT-2019
Filing Date:	
Time Stamp:	23:39:01
Application Type:	Provisional

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$140
RAM confirmation Number	E20190RN39298311
Deposit Account	132490
Authorized User	Alexander Georges

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		19-2070-PRO_Specification.pdf	456593 [illegible]	yes	92

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	77
Claims	78	91
Abstract	92	92

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Drawings-only black and white line drawings	19-2070-PRO_Figures.pdf	663910 [illegible]	no	16

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3	Application Data Sheet	19-2070-PRO_ADS.pdf	1256294 [illegible]	no	8

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Provisional Cover Sheet (SB16)	19-2070-PRO_ProvisionalCoverSheet.pdf	1477413 [illegible]	no	3

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
5	Fee Worksheet (SB06)	fee-info.pdf	30028 [illegible]	no	2

Warnings:	
Information:	
Total Files Size (in bytes):	3884238

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
62/927,119	10/28/2019		140	19-2070-PRO		

CONFIRMATION NO. 5934

FILING RECEIPT

OC000000112807489

20306
MCDONNELL BOEHNEN HULBERT & BERGHOFF LLP
300 S. WACKER DRIVE
32ND FLOOR
CHICAGO, IL 60606

Date Mailed: 11/13/2019

Receipt is acknowledged of this provisional patent application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt identifying the requested changes, preferably by including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Michael T. McNamara, Newport Beach, CA;
Raymond E. Cline JR., Houston, TX;

Applicant(s)

Lancium LLC, Houston, TX;

Power of Attorney:
Alexander Georges--70534

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 11/13/2019
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 62/927,119**
Projected Publication Date: None, application is not eligible for pre-grant publication
Non-Publication Request: No
Early Publication Request: No
**** SMALL ENTITY ****

Title

Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier

license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

Doc Code: PA..
Document Description: Power of Attorney

Confirmation No. 5934

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	62/927119
Filing Date	10-28-2019
First Named Inventor	McNamara, Michael T.
Title	Methods and Systems for Adjusting Power Consumption Based on a Power Option Agreement
Art Unit	
Examiner Name	
Attorney Docket Number	19-2070-PRO

SIGNATURE of Applicant or Patent Practitioner

Signature	/Kurt W. Rohde/	Date (Optional)	2020-06-24
Name	Kurt W. Rohde	Registration Number	62923
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)	LANCIUM LLC		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of ___________ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY BY APPLICANT

Client No. 84008

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application No.	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent): **23644**

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☐ The address associated with the above-mentioned Customer Number.

OR

☒ The address with the Customer Number: **23644**

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Fax			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

LANCIUM LLC
6006 Thomas Rd.
Houston, TX 77041

☐ Inventor or Joint Inventor
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor
☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign
☐ Person Who Otherwise Shows Sufficient Proprietary Interest (*e.g.*, a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity)

Signature	[signature]	Date: June 12, 2020
Name	Michael McNamara	
Title	CEO	

NOTE: **Signature – This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.**

☐ *Total of _____ forms are submitted.

DMS17540308v1

LANCIUM00013346

Electronic Acknowledgement Receipt

EFS ID:	39820880
Application Number:	62927119
International Application Number:	
Confirmation Number:	5934
Title of Invention:	Methods and Systems for Adjusting Power Consumption based on a Power Option Agreement
First Named Inventor/Applicant Name:	Michael T. McNamara
Customer Number:	20306
Filer:	Kurt William Rohde/Mark Sweetin
Filer Authorized By:	Kurt William Rohde
Attorney Docket Number:	19-2070-PRO
Receipt Date:	24-JUN-2020
Filing Date:	28-OCT-2019
Time Stamp:	19:56:53
Application Type:	Provisional

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	19-2070-PRO_POA_Transmittal.pdf	678648 [illegible]	no	2

Warnings:

LANCIUM00013347

Information:	
Total Files Size (in bytes):	678648

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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62/927,119	10/28/2019	Michael T. McNamara	19-2070-PRO

CONFIRMATION NO. 5934

POA ACCEPTANCE LETTER

23644
Barnes & Thornburg LLP (CH)
P.O. Box 2786
Chicago, IL 60690-2786

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NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/24/2020.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

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